AUG 6 1930

With METALLURGICAL SUPPLEMENT.

The Engineer.

Established 1856.

Registered as a Newspaper.

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VOL. CL.—No. 3889] LONDON: FRIDAY EVENING, JULY 25, 1930 [PRICE {WITH SUPPLEMENT} ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

The Director-General, India Store Department, Belvedere-road, Lambeth, London, S.E. 1, invites TENDERS for :—
12 SETS LOCOMOTIVE CYLINDERS and PARTS for CONVERSION of STANDARD ENGINES.
Tenders due 29th August, 1930.
Forms of Tender available from the above at a fee of 5s., which will not be returned. 5473

Crown Agents for the COLONIES.
COLONIAL GOVERNMENT APPOINTMENTS.
APPLICATIONS from qualified candidates are INVITED for the following POSTS :—
M/2255.—ASSISTANT ENGINEER REQUIRED by the GOVERNMENT of HONG KONG for three years' service and possible permanency. Salary £460, rising to £500 a year by annual increments of £20 and then, in the event of the appointment being made permanent, by further annual increments of £20 to £700 a year, and thereafter by annual increments of £25 to £1000 a year, payable locally in dollars under a compensation scheme at present in force at a favourable rate of exchange. Free passages. Candidates, unmarried, age 24 to 30, must have passed Sections A and B of the examinations to qualify for the A.M.I.C.E. Diploma or hold professional qualifications recognised by the Institution of Civil Engineers as exempting from these examinations. Must be good draughtsmen, well up in levelling land and marine surveying and sounding, and must have had some experience in design and construction of port works generally.
M/2269.—WATER and SANITARY ENGINEER REQUIRED by the GOVERNMENT of TRINIDAD for the Public Works Department for three years' service. Salary £750, rising to £800 a year by annual increments of £25. Free passages. Candidates, 25 to 40 years of age, must be A.M.I.C.E. Must have had considerable experience in the preparation of schemes pertaining to water and sanitary works and the execution of such works.
M/2285.—CHIEF DRAUGHTSMAN REQUIRED for the Railway Department of TANGANYIKA TERRITORY for a tour of twenty to thirty months' service and possible extension. Salary £600, rising to £720 a year by annual increments of £30. Free quarters and passages and outfit allowance of £30 on first appointment. Candidates, 25-35 years of age, must be fully versed in design of railway structures of all kinds, including architectural design; must be good organisers, able to take charge of an expanding office and increasing staff. Must possess initiative.
Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting reference number against the appointment for which application is made. 5475

Stores Officers in the ROYAL AIR FORCE.
APPLICATIONS are INVITED from well-educated YOUNG MEN, between 23 and 25 on 1st January, 1931, who have had five years' business experience in a firm of standing, to sit at the examination to be held in October next for the grant of permanent commissions in the Stores Branch of the Royal Air Force.—Apply, SECRETARY (E.R.), Air Ministry, Kingsway, W.C. 2. 5478

Technical Assistants.
TWO MECHANICAL ENGINEERS (unpensionable). Salary £175 to £275 per annum, according to qualifications, plus variable bonus (present total about £266 to £392). Must be British subjects. Age not exceeding 27 years. Preference and age concession to ex-Service men. Degree or equivalent examination certificates and suitable workshop training essential.—Application forms, returnable by 1st August, 1930, from the CHIEF SUPERINTENDENT OF ORDNANCE FACTORIES, Royal Arsenal, Woolwich, S.E. 18. 5477

Armstrong College.
NEWCASTLE-UPON-TYNE.
(IN THE UNIVERSITY OF DURHAM.)

COURSES for the PASS DEGREE of B.Sc. and the HONOURS DEGREE of B.Sc. in MECHANICAL, MARINE, CIVIL or ELECTRICAL ENGINEERING, MINING, METALLURGY, or NAVAL ARCHITECTURE. The curricula of the Pass Degree and the Honours Degree normally occupy periods of three and four years respectively, but candidates presenting evidence of sufficient previous training may be allowed to proceed to either Degree after two years' residence.

The engineering laboratories have recently been extended, and all Departments are equipped for advanced tutorial and research work.

Full particulars of the Courses may be had on application to

THE REGISTRAR,
Armstrong College,
4056 Newcastle-upon-Tyne.

University of Birmingham.
DEPARTMENT OF METALLURGY.
"FEENEY" PROFESSOR : D. HANSON, D.Sc.
The course of study covers three years and leads to the Degree of B.Sc. in Metallurgy. There is also an Honours School. Special attention is devoted to Iron and Steel, Copper, Brass, Metallography, the needs of local industries and to preparation for Colonial and Foreign Posts.
The SESSION 1930-31 COMMENCES on OCTOBER 6th, 1930.
Research and other Scholarships.
For detailed syllabus apply to the REGISTRAR. 5446

The Engineer

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UNIVERSITY OF LONDON.
King's College.
FACULTY OF ENGINEERING.
CIVIL, MECHANICAL, ELECTRICAL and CHEMICAL ENGINEERING.

COMPLETE COURSES of STUDY, extending over three years, are arranged for the Engineering Degrees of the University of London and for the Diplomas and Certificate of the College.
POST-GRADUATE COURSES in CIVIL, MECHANICAL, ELECTRICAL and CHEMICAL ENGINEERING are also provided.

HEADS OF DEPARTMENTS :
Professor A. H. JAMESON, M.Sc., M. Inst. C.E., Civil Engineering (Dean).
C. H. LOBBAN, D.Sc., A.M. Inst. C.E., Reader in Civil Engineering.
Professor J. K. CATTERSON-SMITH, M.Eng., M.I.E.E., Electrical Engineering.
F. S. ROBERTSON, M.I.E.E., Senior Lecturer in Electrical Engineering.
Professor G. COOK, D.Sc., M.I. Mech. E., M. Inst. C.E., Mechanical Engineering.
S. J. DAVIES, M.Sc., Ph.D., M.I. Mech. E., Reader in Mechanical Engineering.
H. W. CREMER, M.Sc., F.I.C., M.I. Chem. E., Chemical Engineering.
Professor S. A. F. WHITE, M.A. } Mathematics.
Professor A. E. JOLLIFFE, M.A. }

Considerable extensions have been made in the Engineering Department. These include a large additional drawing-office, lecture room and laboratory for Hydraulics and Strength of Materials in the Civil and Mechanical Departments, and research rooms, including Wireless Telegraphy, in the Electrical Engineering Department. Large additions have been made to the equipment of the Laboratories in the four Departments for purposes of teaching and research.

There is a College Hostel and a large Athletic Ground.

For full information apply to the SECRETARY, King's College, Strand, W.C. 2. 5448

PUBLIC NOTICES

Heriot-Watt College, Edinburgh
DEPARTMENTS OF MECHANICAL ENGINEERING AND ELECTRICAL ENGINEERING.
MECHANICAL ENGINEERING :
PROFESSOR A. R. HORNE, O.B.E., B.Sc., M.I. Mech. E., A.M.I.C.E.
ELECTRICAL ENGINEERING :
PROFESSOR F. G. BAILY, M.A., M.I.E.E.
FULL-TIME DAY DIPLOMA COURSES leading to professional recognition.
CLASSES COMMENCE 14th OCTOBER.
Full particulars from the College.
J. CAMERON SMAIL, O.B.E., Principal. 5268

The Royal Technical College, GLASGOW.
DEPARTMENTS OF ENGINEERING.
MECHANICS AND MECHANICAL ENGINEERING :
Professor ALEXANDER L. MELLANBY, D.Sc., M.I. Mech. E.
Associate Professor WILLIAM KERR, Ph.D., A.R.T.C., M.I. Mech. E.
ELECTRICAL ENGINEERING :
Professor STANLEY PARKER SMITH, D.Sc., M.I.E.E., A.M. Inst. C.E.
CIVIL ENGINEERING :
Professor GEORGE MONCUR, B.Sc., M. Inst. C.E., M. Amer. Soc. C.E.
MINING ENGINEERING :
Professor DANIEL BURNS, M. Inst. M.E.
CHEMICAL ENGINEERING :
Professor of Technical Chemistry : THOMAS GRAY, D.Sc., LL.D., Ph.D., F.I.C.
Complete courses of instruction are provided, qualifying for the Diploma and Associateship of the College and for the Degree of B.Sc. in Engineering of Glasgow University.
Composition fee, 25 guineas per annum.
SESSION 1930-31 BEGINS on TUESDAY, SEPTEMBER 23rd.
Calendar, by post 3s., and prospectus, gratis, may be obtained on application to the SECRETARY. 5365

PUBLIC NOTICES

Bradford Education Committee
TECHNICAL COLLEGE, BRADFORD.

FULL-TIME DAY COURSES are arranged to meet the needs of Students wishing to present themselves for the DEGREE EXAMINATIONS of the LONDON UNIVERSITY in—
MECHANICAL ENGINEERING,
CIVIL ENGINEERING,
ELECTRICAL ENGINEERING.
Further particulars and prospectuses may be obtained on application to the PRINCIPAL, Technical College, Bradford. 5443

University of Birmingham.
APPOINTMENT OF LECTURER IN DEPARTMENT OF ELECTRICAL ENGINEERING.
APPLICATIONS are INVITED for the POST of LECTURER in MINING ELECTRICAL ENGINEERING.
Stipend £450 per annum. Duties to begin October 1st, 1930.
Four copies of application, with testimonials or references, must be sent on or before August 11th, to the undersigned, from whom further particulars may be obtained.
C. G. BURTON,
Secretary.
The University,
Edmund-street, Birmingham. 5447

University of Birmingham.
FACULTY OF SCIENCE.
ENGINEERING DEPARTMENT.
I.—MECHANICAL ENGINEERING.
"Chance" Professor : F. W. BURSTALL, M.Sc., M.A. (Cantab.), M.I. Mech. E.
II.—CIVIL ENGINEERING (AND TOWN PLANNING).
"Beale" Professor : CYRIL BATHO, M.Sc., D.Sc. (McGill), B.Eng., A.M. Inst. C.E.
III.—ELECTRICAL ENGINEERING.
Professor : WM. CRAMP, D.Sc., M.I.E.E.
The FULL COURSES EXTEND OVER FOUR YEARS, and Students who enter after matriculation and pass successfully the examinations at the end of each year will be ENTITLED TO THE DEGREE OF BACHELOR OF SCIENCE IN ENGINEERING.
The SESSION 1930-31 COMMENCES on OCTOBER 6th, 1930.
For detailed syllabus of the Faculty with full particulars of University Regulations, Lecture and Laboratory Courses, Fees, &c., apply to the REGISTRAR. 5445

University of Bristol.
FACULTY OF ENGINEERING.
(Provided and Maintained in the MERCHANT VENTURERS' TECHNICAL COLLEGE).
Vice-Chancellor : T. LOVEDAY, M.A., LL.D.
Dean of the Faculty :
ANDREW ROBERTSON, D.Sc., M.I. Mech. E., M. Inst. C.E.
DEPARTMENTS.
CIVIL ENGINEERING : Prof. A. J. SUTTON PIPPARD, M.B.E., D.Sc., M. Inst. C.E., M.I. Mech. E., F.R.Ae.S.
MECHANICAL ENGINEERING : The DEAN.
ELECTRICAL ENGINEERING : Prof. DAVID ROBERTSON, D.Sc., M.I.E.E.
AUTOMOBILE ENGINEERING: Prof. W. MORGAN, B.Sc., M.I.A.E.
MATHEMATICS : Prof. E. S. BOULTON, M.A., B.Sc.
GEOLOGY : Prof. S. H. REYNOLDS, M.A., Sc.D.
CHEMISTRY : Prof. F. FRANCIS, D.Sc., Ph.D., F.I.C.
Complete Courses of Study extending over three years leading to the University Degree or Diploma in Civil, Mechanical, Electrical or Automobile Engineering.
Full particulras of Courses and of the University Halls of Residence may be obtained on application to the REGISTRAR, M.V.T. College, Bristol.
The SESSION 1930-31 COMMENCES on OCTOBER 3rd. 5363

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PUBLIC NOTICES

Bombay, Baroda and Central

INDIA RAILWAY COMPANY.

The Directors are prepared to receive up to Noon on Friday, 8th August, TENDERS for the SUPPLY of: WHEELS AND AXLES FOR CARRIAGES AND WAGONS.

Tenders must be made on forms, copies of which, with specification, can be obtained at these offices on payment of £1 each (which will not be returned).

The Directors do not bind themselves to accept the lowest or any Tender.

S. G. S. YOUNG,
Secretary.

Offices: The White Mansion,
91, Petty France, Westminster, S.W. 1,
21st July, 1930. 5465

TO ENGINEERING CONTRACTORS.

City of Liverpool.

The Corporation of Liverpool invite TENDERS for the ENGINEERING WORK required at the proposed Baths and Washhouse at Kensington.

Plans, specification, and form of Tender may be obtained on application to the Baths Manager, 75, Dale-street, on payment of One Guinea, which will be returned on receipt of a bona fide Tender.

Tenders must be enclosed and sealed up in the official envelope provided, addressed to the Town Clerk, Municipal Buildings, Liverpool, and endorsed "Tender for Engineering," and delivered by letter post not later than 10 a.m. on Tuesday, the 26th August, 1930.

The Corporation do not bind themselves to accept the lowest or any Tender.

WALTER MOON,
Town Clerk.

Liverpool, 25th July, 1930. 5449

Clacton Urban District

COUNCIL.
CONTRACT NO. 3.
HOLLAND HAVEN SCHEME.
TO BRITISH MANUFACTURERS OF ELECTRICAL GEAR AND PUMPING PLANT.

The above Council is prepared to receive TENDERS for the COMPLETE EQUIPMENT of ELECTRICALLY DRIVEN PUMPING PLANT of British manufacture, to be installed at a Pumping Station to be erected near Holland Haven.

The works included in the contract consist of Five Stereophagus Pumps, each driven by an Electric Motor, together with all necessary Electrical Equipment and Connections inside the building and other appurtenant Works, in accordance with drawings and specification prepared by the Engineers, Messrs. John Taylor and Sons, Caxton House, Westminster, S.W. 1.

The specification and copy of drawings may be obtained by the manufacturer from the office of the Engineers upon payment of £5 (cheque only), which will be returned upon receipt of a bona fide Tender.

The works form part of a scheme for the relief of the unemployed, and the contract will be subject to special conditions laid down by the Unemployment Grants Committee.

Sealed Tenders, endorsed "Tender for Pumping Plant," must be delivered to the undersigned at his office not later than Noon on Monday, the 18th day of August, 1930.

The Council does not bind itself to accept the lowest or any Tender.

By Order,
(Signed) G. T. LEWIS,
Clerk to the Council.

Council Offices, Clacton-on-Sea. 5463

Clacton Urban District

COUNCIL.
CONTRACT NO. 2.
HOLLAND HAVEN SCHEME.
TO CONTRACTORS.

The above Council is prepared to receive TENDERS for the CONSTRUCTION of about 2300 YARDS of 12in., 21in., and 30in. STONEWARE and CONCRETE TUBE SEWERS, together with MANHOLES and VENTILATING SHAFTS; the CONSTRUCTION of about 290 YARDS of 27in. CAST IRON PUMPING MAIN and about 500 YARDS of 27in. CAST IRON SEA OUTFALL SEWER; the ERECTION of a PUMPING STATION with SUCTION TANK and PUMP CHAMBER and other appurtenant WORKS, in accordance with plans and specification prepared by the Engineers, Messrs. John Taylor and Sons, Caxton House, Westminster, S.W. 1.

Copies of the specification, bill of quantities and form of Tender may be obtained from the offices of the Engineers upon payment of £5 (cheque only), which will be returned upon receipt of a bona fide Tender.

Drawings may be seen at the offices of the Engineers or at the office of the Surveyor, Council Offices, Clacton.

The works are for the relief of the unemployed, and the contract will be subject to special conditions laid down by the Unemployment Grants Committee.

Sealed Tenders, endorsed "Tender for Holland Haven Scheme," must be delivered to the undersigned at his office not later than Noon on Monday, the 18th day of August, 1930.

The Council does not bind itself to accept the lowest or any Tender.

By Order,
(Signed) G. T. LEWIS,
Clerk to the Council.

Council Offices, Clacton-on-Sea. 5462

County Borough of Brighton.

TO BOILERMAKERS AND OTHERS.

The Corporation invite TENDERS for the INSTALLATION of a NEW CORNISH BOILER and STEAM RANGE at the Poor Law Institution, Elmgrove, Brighton.

Specifications and drawings may be obtained from the Borough Engineer and Surveyor, Town Hall, Brighton, on payment of a deposit of Two Guineas, which will be refunded upon receipt of a bona fide Tender not subsequently withdrawn, and the return of the documents.

Tenders, marked "Tender for New Boiler, Poor Law Institution," must be delivered to the undersigned at the Town Hall, Brighton, not later than Twelve Noon on Friday, the 8th day of August, 1930.

JAS. H. ROTHWELL,
Town Clerk.

Town Hall, Brighton,
17th July, 1930. 5451

The Madras and Southern

MAHRATTA RAILWAY COMPANY, Limited, invite TENDERS for:—

(1) 600 STEEL TYRES for CARRIAGES and WAGONS.
(2) 180 STEEL SUPERHEATER and FLUE TUBES and 7080 STEEL BOILER TUBES.
(3) 7416 AXLE-BOXES for CARRIAGES and WAGONS (CAST STEEL or MALLEABLE CAST IRON).
(4) 670 STEEL TYRES for LOCOMOTIVES.
(5) 3365 HELICAL and 2865 VOLUTE SPRINGS.

Tenders are due in on Tuesday, 19th August, 1930, by 2 p.m.

Tender forms obtainable at address below; fee One Guinea each, which is not returnable.

The Directors do not bind themselves to accept the lowest or any Tender.

Company's Offices:
25, Buckingham Palace-road,
Westminster, S.W. 1. 5476

An Engineer, Mines Branch,

Grade 3 (Ferrous Metallurgist), Department of Mines, Ottawa, Canada. Salary range 2820 dollars to 3300 dollars per annum. Qualifications: Education equivalent to graduation in metallurgy from a University or recognised standing with special training in the metallography of iron and steel; four years' experience in the metallurgy of iron and steel in positions of professional responsibility, such as instructor in metallurgy, plant metallurgist or metallographer; a broad training in metallurgy and specialisation in metallography of alloy irons and steels in an alloy steel plant are essential. Research ability, initiative, good physical condition. Age preferably under thirty-five years.—Applications, which may be obtained at Canada House, Trafalgar-square, London, England, should be forwarded to the CIVIL SERVICE COMMISSION, Ottawa, Canada, not later than September 15th, 1930. 5468

PUBLIC NOTICES

Metropolitan Water Board.

TENDERS FOR THE SUPPLY OF STEEL PIPES.

The Metropolitan Water Board invite TENDERS for the SUPPLY of the following STEEL PIPES:—

5670 Yds. 24in. diameter Steel Straight Pipes and Specials.
11,740 Yds. 30in. diameter Steel Straight Pipes and Specials.

The pipes are to be manufactured in accordance with the Board's specification.

Tenders must be submitted on the official forms, which, together with a copy of the specification, may be obtained on and after Thursday, 31st July, 1930, from the Chief Engineer, by personal application at the offices of the Board (Room 155) or upon forwarding a stamped addressed sack envelope.

Tenders, enclosed in sealed envelopes, addressed to the Clerk of the Board and endorsed "Tender for Steel Pipes," must be delivered at the offices of the Board (Room 122) not later than 11 a.m. on Wednesday, 27th August, 1930.

The Board do not bind themselves to accept the lowest or any Tender.

G. F. STRINGER,
Clerk of the Board.

Offices of the Board,
173, Rosebery-avenue, E.C. 1,
19th July, 1930. 5457

Metropolitan Water Board.

TENDERS FOR THE SUPPLY OF CAST IRON PIPES.

The Metropolitan Water Board invite TENDERS for the SUPPLY of CAST IRON STRAIGHT PIPES and SPECIALS (Tender No. 3) for the periods of 6 and 12 months, commencing 1st October, 1930.

Tenders must be submitted on the official forms, which may be obtained on and after Monday, 28th July, 1930, from the Chief Engineer, by personal application at the offices of the Board (Room 155) or upon forwarding a stamped addressed sack envelope.

Tenders, enclosed in sealed envelopes, addressed to the Clerk of the Board and endorsed "Tender for Cast Iron Pipes," must be delivered at the offices of the Board (Room 122) not later than 11 a.m. on Wednesday, 27th August, 1930.

The Board do not bind themselves to accept the lowest or any Tender.

G. F. STRINGER,
Clerk of the Board.

Offices of the Board,
173, Rosebery-avenue, E.C. 1
19th July, 1930. 5459

Metropolitan Water Board.

MAINS FOR THE IMPROVEMENT OF SUPPLY TO THE AREAS OF NORTH AND SOUTH WOOLWICH.

The Metropolitan Water Board invite TENDERS for the LAYING of the undermentioned MAINS:—

(A) 6050 Lineal Yards of 24in. Main.
640 Lineal Yards of 18in. Main, from the Board's Deptford Works to Ransom-road, Woolwich-road, in the Metropolitan Borough of Greenwich; and
510 Lineal Yards of 20in. Main, along Parkroad, from the Board's Reservoir in Heavitree-road, Plumstead.
(B) 12,000 Lineal Yards of 30in. Main, from the Board's Honor Oak Pumping Station, Hallroad, Peckham, to the Woolwich Tunnel, in the Metropolitan Boroughs of Camberwell, Lewisham, Greenwich and Woolwich.

The drawings and contract documents may be inspected without charge at the offices of the Board (Room 201).

Forms of Tender, conditions of contract, specification and bills of quantities, together with drawings and a spare copy of the bills of quantities, may be obtained on and after Wednesday, 6th August, 1930, from the Chief Engineer, on production of an official receipt for the sum of £10, which must be deposited with the Accountant to the Board, and which will be returned on receipt of a bona fide Tender accompanied by all the above-named documents and drawings (with the exception of the spare copy of the bills of quantities, which may be retained by the tenderer). Such payments and applications must be made between the hours of 10 a.m. and 4 p.m. (Saturdays, 10 a.m. and 12 noon). Cheques must be made payable to the Metropolitan Water Board and not to individuals.

Tenders, enclosed in sealed envelopes, addressed to the Clerk of the Board and endorsed "Tender for Mains for the Improvement of Supply, North and South Woolwich," must be delivered at the offices of the Board (Room 122) not later than 11 a.m. on Wednesday, 27th August, 1930.

The Board do not bind themselves to accept the lowest or any Tender.

G. F. STRINGER,
Clerk of the Board.

Offices of the Board,
173, Rosebery-avenue, E.C. 1,
19th July, 1930. 5457

South Indian Railway Company, Limited.

The Directors are prepared to receive TENDERS for the SUPPLY of:—

500 STEEL DRAW-BAR SHACKLES.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Steel Draw-bar Shackles," with the name of the firm tendering, must be left with the undersigned not later than Twelve Noon on Friday, the 8th August, 1930.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 2s. 6d. for each copy of the specification.

Copies of the drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.

91, Petty France, Westminster, S.W. 1,
23rd July, 1930. 5479

The South Indian Railway

COMPANY, LIMITED.

An ASSISTANT WORKS MANAGER (PLANNING) is REQUIRED for the Locomotive and Carriage and Wagon Workshops of the above Railway at Trichinopoly.

Candidates, who should be between the ages of 30 and 35 years, should have had a first-class education and subsequent training as a Mechanical Engineer in Railway or Manufacturing Workshops. They should be fully conversant with modern workshops practice, have held administrative positions in large engineering workshops, and have had special experience in the production branches of large engineering works.

The salary of the appointment, which in the first instance will be for three years, will commence at Rupees 750 per month for the first year, rising by annual increments of Rs. 50 per month to Rupees 850 per month for the third year, and in the event of extended service to a maximum of Rupees 1250 per month.

In addition to the above-named salary overseas allowance will be paid at the rate of £25 per month for the first year and £30 per month for the subsequent years.

A first-class passage to India will be provided by the Company, as also, subject to the terms of agreement, a free passage home in the event of the termination of the service at or before the end of the three years. If the employment is extended beyond that period the employee will become eligible for certain free passage concessions for himself and his family.

Salary will commence on the date of embarkation for India.

The successful candidate will be entitled to the benefits of the Railway Provident Institution.

Forms upon which application must be made may be obtained on written application to Messrs. ROBERT WHITE and PARTNERS, 3, Victoria-street, London, S.W. 1, the Consulting Engineers to the Company. 5450

PUBLIC NOTICES

Applications from Qualified

CIVIL ENGINEERS are INVITED for the POST of EXECUTIVE ENGINEER (permanent) to the Public Works Department, Jodhpur State, Rajputana, India.

Candidates should be in the neighbourhood of 32 years of age, Public School or University, and be possessed of A.M. Inst. C.E., or an exempting degree.

Preference will be given to those having had intimate experience of WATERWORKS and Drainage, in addition to Roads and Buildings.

Initial salary will be determined by age, based on an initial figure of Rupees 500 per month up to age 24, increased by Rupees 50 per month for each year of greater age. Rupees 50 per month increase each year of service.

Free quarters simply furnished, free motor car and passages. Provident Fund in lieu of pension. Leave according to State Rules.

Medical examination.

Further particulars available from the Publisher, THE ENGINEER (Box P1000), 28, Essex-street, W.C. 2.

Apply at once by Air Mail letter, stating age, married or single and giving full particulars, qualifications and experience, to S. G. EDGAR, I.S.E., Superintending Engineer, P.W.D., Jodhpur, Rajputana, India. 5440

County Borough of Derby.

APPOINTMENT OF CHIEF RESIDENT ENGINEER.

The Corporation REQUIRE the SERVICES of a CHIEF RESIDENT ENGINEER in connection with the Construction of Works for the Improvement of the Channel of the River Derwent, including Weirs, Sluices, Cuts, &c., and Extensions to the Sewage Disposal Works, embracing Filters, Humus Tanks, &c.

Applicants must be fully conversant with and thoroughly experienced in the duties of a Resident Engineer in charge of public works carried out either by contract or direct administration.

The appointment will be for the period of construction (subject to satisfactory service), which, it is estimated, will occupy between two and three years.

The person appointed will be required to act under the direction of the Corporation's Consulting Engineers.

Salary £750 per annum.

Applications, on the prescribed form, which may be obtained at this office, stating age and qualifications, together with copies of not more than three recent testimonials, and endorsed "Appointment of Chief Resident Engineer—River Improvement and Sewage Disposal Works," should be delivered to me not later than August 5th next.

G. TREVELYAN LEE,
Town Clerk.

Town Clerk's Office,
Market Place, Derby. 5428

Devon County Council.

(NORTHERN AND WESTERN DIVISIONS, COUNTY ROADS).

APPLICATIONS are INVITED for the POST of JUNIOR ASSISTANT ENGINEER.

Salary at the rate of £210 per annum, rising by annual increments of £12 10s. to £300, together with travelling allowance in accordance with the Council's mileage scale whilst on duty.

The appointment will be subject to the provisions of the Local Government and Other Officers' Superannuation Act.

Applicants must have had good civil engineering experience after pupilage, preferably on Road, Railway or Bridge Construction.

Applications, on the official form, with copies of three testimonials of recent date, must reach the undersigned not later than Tuesday, 5th August, 1930.

R. M. STONE,
County Surveyor.

9A, High-street, Barnstaple,
July 19th, 1930. 5455

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, Experienced TRANSFORMER DESIGNER.—Address, stating age, experience, and salary required, 5444, The Engineer Office. 5444 A

WANTED, GENERAL MANAGER, Age Round 35, for medium size, old-established, very busy Midland Engineering Works, manufacturing wide range of machinery for the heavy trades. Position offers great possibilities. An applicant preferred who has reasonably wide engineering knowledge with strong commercial experience. In confidence, full details last experience and employers.—Address, P100, The Engineer Office. P100 A

ASSISTANT ENGINEER.—APPLICANTS for the POSITION advertised in this journal on June 20th are THANKED for their replies and informed that the VACANCY is now FILLED.—HENRY HOPE and SONS, Ltd., Smethwick, Birmingham. 5480 A

CIVIL ENGINEER, Energetic and with Experience of Marine Work, REQUIRED for Jetty Construction in London district. State previous experience and salary required.—Address, 5452, The Engineer Office. 5452 A

CIVIL ENGINEERING DRAUGHTSMAN REQUIRED AT ONCE. Man with all-round experience. Give full details past experience and salary.—Address, 5453, The Engineer Office. 5453 A

CIVIL ENGINEER REQUIRED IMMEDIATELY as Owner's Representative during execution of important heavy foundation contract near London. Energy and tact essential. Age 30/40. Give details previous experience and salary.—Address, 5454, The Engineer Office. 5454 A

ENGINEERING ASSISTANT WANTED in Contractor's Office near London. Experienced in the calculations and designing of Reinforced Concrete Structures and possessing a good general knowledge of construction. Salary about £300 per annum.

Address, stating age, experience, and references, 5467, The Engineer Office. 5467 A

ENGINEER DESIGNER REQUIRED, with Wide experience in design and development of successful modern Compression Ignition Engines for use in Road Motor Vehicles. Midland district.—Address, 5466, The Engineer Office. 5466 A

INDUSTRIAL ENGINEER WANTED for Permanent Post, Education B.Sc. Standard, to make Time and Production Study. At least four years' works experience essential. Candidates replying should give details of education, past experience, &c., and must be able to supply highest personal reference. State salary required.—BOULTON and PAUL, Ltd., Norwich. 5471 A

MECHANICAL ENGINEER REQUIRED, Age 30 to 35, to Take Charge of the Machinery in the Printing Works of a large Provincial Daily Paper. Applicants must have B.Sc. University Degree or be corporate members of the Institution of Mechanical Engineers. They must have had shop training and be experienced in the design and operation of intricate machinery.

Applications must be accompanied by three recent testimonials or references giving particulars of general and technical education. State age and salary expected.

Address, 5490, The Engineer Office. 5490 A

METALLURGICAL CHEMIST REQUIRED IMMEDIATELY. Must have previous experience of analysis of general engineering works material. State age and experience.—Address, 5470, The Engineer Office. 5470 A

REINFORCED CONCRETE DESIGNERS (Senior) WANTED; sound theoretical knowledge and experience in specialist firm essential.—Write, stating age, experience, and salary required, to INDUSTRIAL CONSTRUCTIONS, Ltd., 54, Victoria-street, S.W. 5489 A

SITUATIONS OPEN (continued)

SUPERINTENDENT for Erecting Shop of Commercial Vehicle Works. State fully (in confidence) experience, age, and salary.—Address, 5485, The Engineer Office. 5485 A

WORLD-WIDE ORGANISATION Has VACANCY in London for successful qualified ENGINEER SALESMAN. Intimate connection with railway and tramway undertakings essential. Good prospects for active educated man.

Send full particulars, which will be considered confidential.—Address, 5487, The Engineer Office. 5487 A

WANTED, an Experienced DRAUGHTSMAN. A thorough knowledge of Hydraulic Cranes and Hoists essential.—Apply by letter only, stating age and salary required, to the HYDRAULIC ENGINEERING COMPANY, Ltd., Chester. 5452 A

WANTED, MARINE ENGINE DRAUGHTSMEN, accustomed to Pipe Arrangement and Detail Work. Age 25 to 35.—Apply, stating age, experience, and salary required, to "MARINE," Wm. Porteous and Co., Advertising Agents, Glasgow. P74 A

DRAUGHTSMAN, Experienced Estimating and designing Calorifiers, Air and Water Heaters, Evaporators, &c. Also DRAUGHTSMAN with good experience Modern Pumping Machinery. State age, experience, and salary required.—Address, 5483, The Engineer Office. 5483 A

DRAUGHTSMEN (TWO) REQUIRED, One Experienced in Layouts and one in Detail Work on Large and Medium-size Diesel Oil Engines. State age, experience, and salary required.—Address, 5484, The Engineer Office. 5484 A

DRAUGHTSMAN.—WANTED, SENIOR MAN with considerable experience as Jig, Tool and General Mechanical Engineering Designer, by large firm manufacturing high-class Automatic Machines, situated 20 miles from London.—Address, stating age, experience and salary required, 5388, The Engineer Office. 5388 A

FIRST-CLASS DESIGNING DRAUGHTSMAN REQUIRED. Must be fully qualified and experienced man, capable of making own calculations. State in full detail the class of work previously engaged in, in sequence of appointments held, also age, salary required.—Address, 5486, The Engineer Office. 5486 A

LEADING DRAUGHTSMAN, Having Sound Mechanical and Electrical experience with design of large Power Transformer Apparatus.—Address applications in confidence, stating age, experience, and salary expected, 5442, The Engineer Office. 5442 A

WANTED, MACHINE SHOP FOREMAN, Used to latest methods of accurate production on Lathes, Boring and Milling Machines, Grinders, &c., with some knowledge of the Design of Tools and Jigs. N.E.C. State experience, age, and salary required.—Address, 5437, The Engineer Office. 5437 A

SITUATIONS WANTED

A FULLY qualified COMMERCIAL ENGINEER DESIRES a POSITION as LONDON REPRESENTATIVE with or without office facilities and services. Has a good connection and is greatly experienced in Pumps and Installations, Oil and Gas Engines, Steam Engines and Boilers and general engineering. Salary and Commission.

Address, 5433, The Engineer Office. 5433 B

ADVERTISER SEEKS POST; Exp. Gen. Eng., automobile, railway, constructional works and contractors, home and abroad. Wide exp. in responsible positions. Disengaged Aug. 1st.—Address, P7167, The Engineer Office. P7167 B

ASST. WORKS MANAGER or SIMILAR POSITION DESIRED by Mech. Engineer (33). Hons. B.Sc., all-round experience, foundry specialist.—Address, P114, The Engineer Office. P114 B

CENTRIFUGAL PUMPS.—CHIEF ENGINEER and DESIGNER, with extensive experience in all types of high and low-lift centrifugal pumps, DESIRES CHANGE; reasonable salary.—Address, P38, The Engineer Office. P38 B

COMMERCIAL ENGINEER, Sales Director of company marketing engineering specialities to railways (home and abroad), power stations, shipping companies, and having wide connection with industrial concerns also, would be PLEASED to CONSIDER LONDON and/or MIDLANDS REPRESENTATION with or without office accommodation. Engineering, chemical and metallurgical qualifications.

Address, P117, The Engineer Office. P117 B

COMPETENT ENGINEER, Well Experienced, mechanical, electrical and commercial, SEEKS CHANGE to South of England. Fluent French and German, A.M.I.E.E. Sound representation equally acceptable.—Address, P107, The Engineer Office. P107 B

COST, STORES AND PROGRESS RECORDS.—ENGINEER SPECIALIST WANTS POST with large Manufacturing Firm, London District preferred. University education. Twenty years' works and commercial experience.—Address, P81, The Engineer Office. P81 B

ENGINEER (32), First Class B.O.T. Steam Certificate with motor endorsement, sound technical education, SEEKS RESPONSIBLE POSITION. Experienced with steam, internal combustion engines, pumps, boilers, electricity. Good references.—Address, P113, The Engineer Office. P113 B

For continuation of Small Advertisements see page 4.

LOCOMOTIVE . MARINE . STATIONARY
"M.L.S."
SUPERHEATERS
To suit all requirements.
Specialists in Design and Manufacture
The SUPERHEATER COMPANY LIMITED
BUSH HOUSE, ALDWYCH, W.C. 2.
515 A

A Seven-Day Journal

The C.P.R. Liner Empress of Britain.

SOME further interesting particulars are now available concerning the propelling machinery of the quadruple-screw 42,000-ton C.P.R. liner "Empress of Britain," which is being completed at Messrs. John Brown's Clydebank yard. In order to meet the combined requirements of the winter Atlantic service and summer cruising services, the two inboard propeller, will be driven by turbines in the forward engine-room, designed for an output of two-thirds the total power required, while the two outer propeller, will be driven by turbines in the after engine-room, which will develop one-third the total designed output. When cruising, it is intended only to employ the forward turbines and so to run the liner as a twin-screw ship. The astern turbines are, therefore, embodied in the forward engine-room turbines, which drive the inner screws, and the after turbines, driving the outer screws, are to be used only for ahead running. A similar division of power has been arranged in the boiler-rooms. In the after boiler-room there are six 425 lb. pressure Yarrow boilers, which normally supply the forward inboard turbines and two Yarrow and one Johnson boiler in the forward boiler-room, which will normally supply steam to the outboard turbines in the after engine-room. The steam connections are, however, such that any or all of the boilers can supply steam to the forward engine-room with the larger inboard ahead and astern turbines. In the forward boiler-room there are also two 200 lb. pressure Scotch boilers, which will supply auxiliary steam and heating steam for ship's use. Most of the engine-room and deck auxiliary machinery will be electrically driven, current being provided by four oil-engine-driven generator sets and two turbo-generator sets. The whole of the machinery has been designed on the basis of experience gained with the "Duchess" and "Empress" class liners now in service, and very economical fuel consumptions are confidently expected.

Thames Floods.

A NEW scheme to prevent Thames flooding was put forward by Mr. A. B. Buckley at a recent meeting of the Thames Valley branch of the Council for the Preservation of Rural England. The scheme, which has been drawn up for Lord Mayo, provides for four storage reservoirs for surplus water which could be discharged when the flow of the river fell. It is claimed that the scheme offers a practicable alternative to the proposal of straightening and enlarging the River Wey and carrying out extensive works in the River Thames itself between Weybridge and Teddington. The reservoirs would command the flow of the Windrush, the Evenlode, the Cherwell, the Thame and the Kennet, and would control collectively 38 per cent. of the Thames when in flood. Referring to the volume of water to be dealt with, Lord Desborough, Chairman of the Thames Conservancy Board, said that 1in. of rain was equal to a body of water 670 miles long, 250ft. wide and 10ft. deep, and it was questionable whether the proposed reservoirs would be of sufficient capacity to deal with such a volume of water. The construction of storage reservoirs had been considered long ago, and one authority had said that they would have an infinitesimal effect on the flow. He (Lord Desborough) found it difficult to accept Mr. Buckley's figures as to the water that had to be carried off, and he thought that the estimated cost of the scheme, namely, £3,400,000, was far too low. His figure as to the estimated minimum storage required to eliminate floods was 120,000,000,000 gallons, which, at a capital cost of £200 per 1,000,000 gallons, worked out at £24,000,000. Nevertheless, he hoped that the scheme would receive the examination it deserved.

Fires in Bunker and Cargo Coal.

IN a Journal note which was published in our issue of January 24th last, reference was made to a report then issued by the Department of Scientific and Industrial Research on the causes of 336 fires which, in a period of three years, took place on 272 ships. In a notice lately issued to shipbuilders, shipowners, masters of ships and engineers, the Mercantile Marine Department of the Board of Trade draws attention to this report and indicates certain precautions which it is desirable to take in order that such fires may be prevented. It emphasises the detrimental effects of local heating, and suggests that small quantities of coal which are often left after a voyage should be so trimmed that they are quickly used up and are not mixed with other coals. Attention is further drawn to the importance of preventing air paths through coal in bunkers, and methods of building air-tight bulkheads are outlined. On the other hand, the necessity of adequate ventilation for the removal of explosive gases is not overlooked, and measures which are to be taken to make such ventilation effective are indicated. With regard to ships making long voyages with coal cargoes, the desirability of thoroughly sweeping the holds before loading the coal is mentioned and instructions for the proper ventilating of the holds are given. Means for ascertaining the temperature of the coal at different levels in the bunkers or holds are held to be necessary, as is the provision of suitable thermometer tubes. With long-voyage ships it is considered undesirable that chipping and painting should be done on the voyage below decks, as by such work the danger of fire from smoking or from oily waste is increased. The Board invites all interested to study the report we have referred to and to co-operate in the carrying out of the precautionary and safety measures we have outlined above.

A Serious Air Disaster.

DISASTER overtook an all-metal Junker monoplane while flying on Monday afternoon over Meopham, Kent, on its way from Berck-sur-Mer to Croydon. At present all that can be said is that the machine apparently went to pieces in the air. The engine, wings, fuselage and the bodies of the four passengers and the two pilots were found distributed over a considerable area. The machine was almost new, having being flown previously only for about a hundred hours. It belonged to the Henderson Flying Bureau. The head of that organisation, Lt.-Col. G. L. Henderson, one of the country's best-known pilots, was in charge of the machine at the time of the disaster, although it would appear that it had temporarily been lent to another undertaking, the Walcot Air Lines. The second pilot was Mr. C. D. Shearing, and the four passengers were the Marquis of Dufferin and Ava, Viscountess Ednam, Sir Edward Ward, and Mrs. Loeffler. The cause of the accident has not yet been made clear. That it demands rigorous investigation is, in the interests of civil aviation, certain. In the opinion of many people the circumstances are such as to justify the publication of the official findings as to the cause, and it is held that the policy of secrecy commonly adopted by the Air Ministry with regard to its accident investigations is likely to prove more harmful than beneficial.

Two New Torpedo-Boat Destroyers.

Two new torpedo-boat destroyers which have lately taken the water are the flotilla leader H.M.S. "Keith," launched by Vickers-Armstrongs, Ltd., at Barrow-in-Furness; and the Canadian destroyer "Saguenay," which was recently launched from the Woolston Yard of John I. Thornycroft and Co., Ltd., at Southampton. The "Keith" has an overall length of 323ft. with a breadth of 32·3ft., and a depth to the upper deck of 19ft. She will be propelled by two sets of Parsons single-reduction geared turbines, each comprising one high-pressure and one low-pressure turbine working in series. The condensers will be of the underslung regenerative type and the total designed output of the turbines is 34,000 S.H.P. Steam will be supplied from three Yarrow water-tube boilers oil fired, designed for a working pressure of 300 lb. per square inch with a superheat of 200 deg. Fah. Two 50-kW turbo-generator sets and one 20-kW oil engine-driven generator set are to be provided. The "Saguenay" is a sister ship of the "Skeena," which is also being built by Thornycrofts under Admiralty supervision for Canadian service. Both are to be delivered next spring and are designed to operate with destroyers of the "Acasta" class, having approximately the same speed and armament. Although they are of about the same dimensions as the "Acasta," a special Thornycroft design has been chosen, which includes such features as heavier scantlings, more elaborate heating, and special accommodation arrangements, all of which are particularly suited to Canadian requirements. The "Saguenay" has an overall length of 321ft., with a breadth of 32·5ft., and a displacement of 1320 tons. She will have a designed speed of 35 knots and will be propelled by twin-screw single-reduction geared turbine machinery, steam being raised in Thornycroft oil-fired water-tube boilers.

The British Association Bristol Meeting.

THE advance programme of the British Association meeting at Bristol from September 3rd to 10th indicates that so far as Section G (Engineering) is concerned, matters of considerable interest will be discussed. On Thursday, September 4th, there will be a general discussion on internal combustion engines, with papers by Mr. T. F. Harley and Mr. R. Cook, on "The Influence of Turbulence upon Highest Useful Compression Ratio"; by Mr. C. F. Abell, on "Some Recent Progress in Air-cooled Aero-engine Development," and by Mr. S. J. Davies and Mr. E. Giffen, on "The Present Position of the High-speed Heavy-oil Engine." On the following day—Friday, September 5th—Sir Ernest W. Moir will deliver his Presidential Address to the Section, which will be followed by a discussion with Section I (Physiology) on "Air Pressure Variations Encountered in Engineering Works and their Physiological Effects," to which, among others, the President of the Section, Capt. G. C. C. Damant, Mr. R. H. Davies and Professor Sir Leonard Hill, F.R.S., will contribute. On Monday, September 8th, Section G will have a comprehensive discussion on "The Trend of Airship Construction," in the course of which papers will be submitted by Lieut.-Colonel V. C. Richmond on "The Development of the Rigid Airship," by Mr. B. N. Wallis on "The Design and Construction of H.M.A. 'R 100,'" and by Herr Direktor W. E. Doerr on "The Airship 'Graf Zeppelin.'" On Tuesday, September 9th, "The Economical Production of Power" is the subject for discussion, the basis being papers by Mr. G. A. Orrok on "High Steam Pressure Plants in America;" by Sir Henry Fowler, K.B.E., on "The Question of Fuel Consumption in Locomotive Practice," and by Mr. A. Lennox and Mr. Theodore Stevens on "Obscured Fundamentals in the Development of Integrated Electricity Supply." Finally, on Wednesday, September 10th, there will be three papers relating to structural steel design and structural steel regulations by Mr. J. S. Wilson, Mr. J. S. Lewis and Professor C. Batho, the session closing with the presentation of reports of committees.

Low-Temperature Coal Carbonisation.

IN order to promote the interests of the various firms engaged in the low-temperature coal carbonisation industry, a new association styled the "Low Temperature Coal Distillers' Association of Great Britain," which includes representatives of the principal firms engaged in low-temperature carbonisation work, has recently been formed. The Chairman of the new body is Colonel W. A. Bristow, the managing director of Low Temperature Carbonisation, Ltd., operating the "Coalite" process, and the Vice-chairman is Lieut.-Colonel J. T. C. Moore-Brabazon, who is the chairman of L. and N. Distillation, Ltd. The Honorary Secretary is Lieut-Commander Colin Buist, and the offices of the Association are at 39, Grosvenor-place, London, S.W.1. Among other leading processes represented on the Committee are the "Hind" process, the "Maclaurin" process, and that of the Midland Coal Products, Ltd. It is intended that the Association shall act as representing the industry in all negotiations with the Government, the mining industry and the Fuel Research Board. It will also take such measures as will promote the interests of the industry as a whole. Matters such as the further economic production of smokeless fuel, with its valuable by-products, and the marketing of tar oils suited for use in high-power oil engines, are matters which will no doubt receive the attention of the Association.

A Canal Improvement Scheme.

THE announcement is now officially made that the scheme of development put forward by the Grand Union Canal Company for the London to Birmingham Canal has received the approval of the Government in principle, and that it will be proceeded with as soon as a Bill has been laid before Parliament and the proportion of unskilled labour to be employed settled to the satisfaction of the Ministry of Labour. The total cost of the scheme is £881,000, and an additional expenditure of £150,000 is proposed for works which will ultimately allow craft 14ft. wide to use the canal throughout its length. The main work which will be first undertaken will include the reconstruction of locks, bridges and passing places, the provision of pumping stations, and the dredging, concrete walling and piling of certain sections of the canal. The reconstruction work is to be completed within three years, and the whole of the works proposed within six years of beginning the scheme. On one section of the canal, between Napton and Birmingham, it is proposed to rebuild and extend fifty-two locks and to enlarge the bridges so that larger boats can use the canal. By this means boats loaded on the river Thames will be able to proceed to their destination without the transshipment of their loads from barges to narrow boats, which is at present necessary.

The Ex-German Battle Cruiser Hindenburg Refloated.

ON Wednesday last, July 23rd, Mr. E. F. Cox, of Cox and Danks, Ltd., who is in charge of the salvage operations at Scapa Flow, reported that the battle cruiser "Hindenburg" was afloat with her decks free of water. She will be immediately towed into Mill Bay, where she will be prepared for her last voyage to the Firth of Forth for the purpose of breaking up. As recorded in our Journal note of May 16th, the preparatory work of salvage included the casting of a reinforced concrete block around the propellers on the port side of the ship. When pumping operations were begun on June 18th, the vessel rose but had a pronounced list to starboard. It was decided to sink her again and cast another concrete block on the starboard side of the ship at the stern. Pumping was renewed on Tuesday, July 15th, and the hull immediately rose at the bow, with a list of only 2½ deg. The following day the top of the bow was 35ft. above water, with 3 deg. of list. All pumps were then placed aft and the suctions were let down to within 5ft. of the bottom of the ship. On Tuesday, the 22nd inst., divers reported that the bottom of the ship was 12ft. from the bottom of the sea, and pumping was continued with ten pumps in operation, the vessel being completely refloated the following day following a slight pause on account of stormy weather. Mr. Cox and his staff of engineers are to be congratulated on the early success which has attended their well-planned salvage operations. Work will shortly begin on two further ships, the "Prinz Regent Luitpold" and the "Von der Tann."

The Britannia Works, Huddersfield.

No. II. (*Conclusion*).*

WIDIA TOOL DEPARTMENT.

As already mentioned, the employment of Widia-tipped tools was necessitated for machining the extremely hard Platnam valve parts, and many of the machine tools had to be modified to enable Widia to be used to the best advantage, belt drives in many cases having to be replaced by individual motor drives.

The Widia department is in charge of a competent man under the control of the tool-room foreman. This department is equipped with the following machines:—A small end milling machine for milling accurate

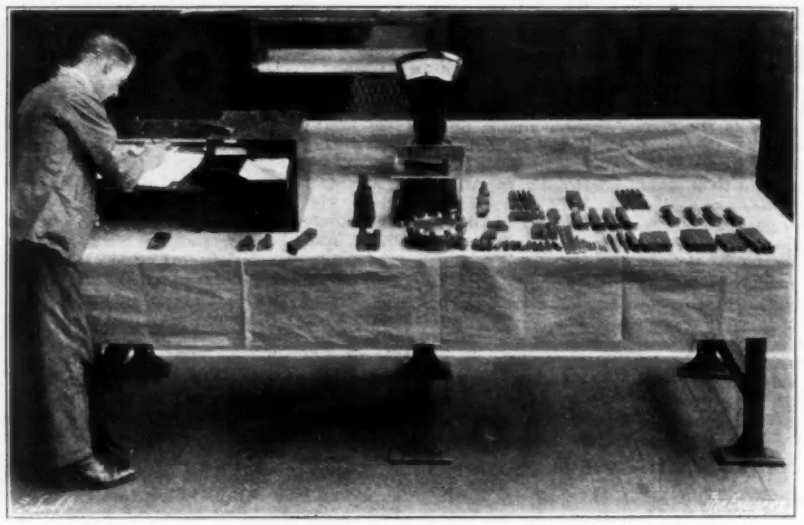


FIG. 9—WIDIA TOOLS AND WEIGHING MACHINE

seats on special steel butts or shanks for the reception of Widia tips, a Lumsden oscillating tool grinder, a Lumsden cup wheel grinder, a Herbert twist drill grinder, a Ward cutter grinder, a Schuchardt and Schütte grinder, two Churchill tool grinders and an Avery automatic scale—Fig. 9—with a special chart graduated up to 4 oz. by 1 dram divisions. This machine was made specially for the exact weighing of the tips as received and as a check on invoice weights and the shanks prior to and after the setting of the tips, as well as for weighing after each grinding operation. In addition to weighing up to 7 lb., it actually indicates visibly each dram of weight on the chart. In order to check the amount of consumption of Widia at each re-grinding process, it was necessary to determine beforehand the amount of clearance angle required, and this angle is adhered to in subsequent grindings by the use of cup wheels and the correct setting of the angle of the tool rest while grinding. The amount of butt ground away is arrived at by a simple calculation based on tests made, and the difference gives the weight of Widia remaining.

The Churchill 10in. double tool, Ward cutter and Schuchardt-Schütte grinders were installed so as to use up the cup wheels when the face was worn down flush with the wheel side. They are used both on the side and edge, but the tool is always finish ground either on the side of a disc wheel or on the face of a cup wheel in order to maintain the clearance angle, for weight-checking purposes.

Each Widia tool is painted red and numbered to correspond with the machine on which it is used, the chief reason for this being to attract the attention of the production engineer and to enable him to see whether all the tools of a lay-out are of Widia or not. An interesting example of the use of this new metal was mentioned to us. On a 52in. vertical boring machine driven by a 30 H.P. motor operating on a 16in. cast steel parallel slide valve, two Widia tools in 1¼in. butts removed the metal with $^{1}/_{32}$in. feed, ⅜in. depth of cut, at a cutting speed of 220ft. per minute without lubricant. The cut was uneven owing to the position at which the pads were cast on the faces and there was sand present, but the Widia tool cut clean across and was again used on the return feed for a finishing cut.

It is of interest to record that the original tools bought in June, 1928, are still in use, and a recent inventory showed that there were more tips then in use than were purchased. This is accounted for by the fact that, in the early stages before the proper cutting angle was worked out, and before the machines were provided with sufficient power, the tips would occasionally chip, and these chippings were made into tools for finer work. In view of the interest which is taken at the present time in nitrogen hardening and the difficulty of machining objects so treated, it will be of further interest to our readers to learn that such operations can be carried out by employing Widia.

NITROGEN HARDENING.

The case-hardening of special steels by ammonia gas is a process that is receiving much attention by up-to-date engineering firms, and a plant for this purpose has been installed in Messrs. Hopkinson's works. In this process, the finish machined parts to be treated are placed in a gas-tight box of special heat-resisting steel, provided with inlet and outlet tubes for the circulation of ammonia gas. The parts are loosely placed in the box without the use of any packing material, the individual layers being separated by nickel wire netting to permit free circulation of the gas. The box is placed in the electric furnace, the door is sealed up, and the furnace is brought up to a temperature of 500 deg. Cent. The ammonia is supplied direct from cylinders, and discharges through a water bottle, which gives about ½in. back pressure. During the process of nitration, it is merely necessary to see that the flow of ammonia is maintained and that the temperature is kept within plus or minus 5 deg. of 520 deg. Cent.

When the nitration period is completed, the furnace is allowed to cool down quickly to 370 deg. Cent., the box is taken out and the parts are removed as soon as they are cool enough to handle. No further treatment is required, and the articles can be used immediately, unless it is desired to get rid of the extremely thin grey film which remains on the surface. This can be done by buffing or lapping. If any parts of the articles are to be kept soft, they must be suitably protected from ammonia gas by tinning or some other means. The casing obtained by this process is much harder than anything previously known in case-hardening. It will cut glass and even quartz and cannot be touched by special testing files. The resistance to wear is correspondingly great, being many times greater than that of cemented and quenched steels. The comparatively low temperature at which the nitration process is carried out obviates all risk of distortion, provided that all the stresses set up in the steel by working or machining have been previously removed by annealing at a temperature above 520 deg. Cent.

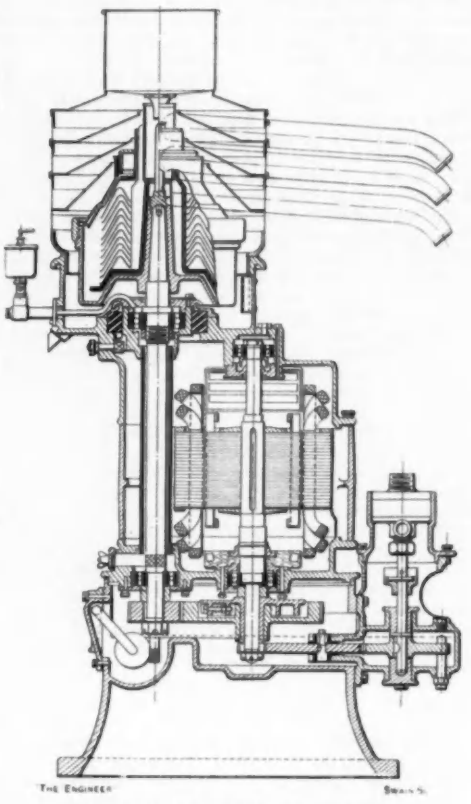


FIG. 11—SECTION OF OIL PURIFIER

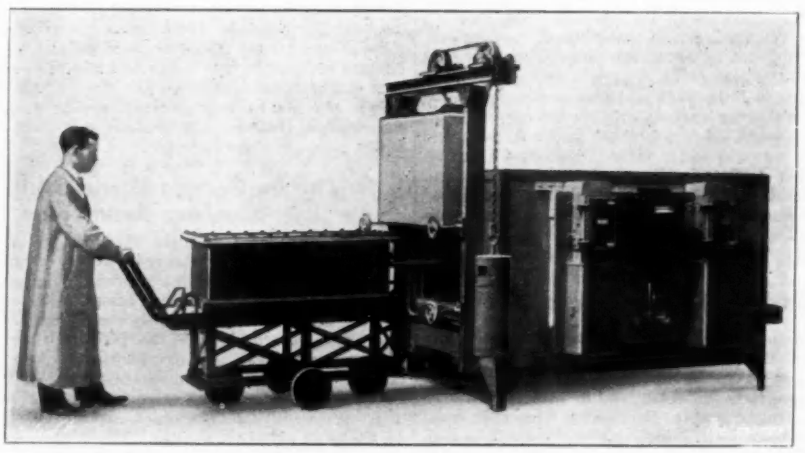


FIG. 10—NITROGEN HARDENING PLANT

Messrs. Hopkinson have carried out a large number of experiments with this process to ascertain how far it can be adopted in valve manufacture, but we are informed that as regards valves and seatings for the higher temperatures, the results so far obtained do not justify the replacement of Platnam metal by nitrogen treated steels. There appears to be no doubt, however, that the claims made for the process as regards cheapness, simplicity of operation, cleanliness, freedom from distortion and cracking, are amply justified. It should be pointed out that the parts treated swell slightly during nitration, but, as the swelling is regular and uniform throughout, it can be allowed for in machining operations. A view of the

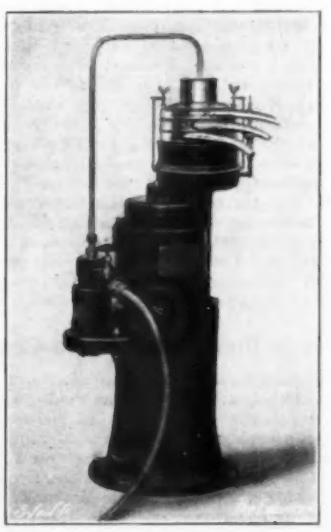


FIG. 12—STATIONARY OIL PURIFIER

* No. I. appeared July 18th.

nitration furnace supplied by Nitralloy, Ltd., Sheffield, is given in Fig. 10.

The Hopkinson Oil Purifier.

Space will only permit of a description of a few of the most interesting products, one of which is an improved centrifugal oil purifier. Illustrations of this appliance are given in Figs. 11–14. It is one of Hopkinson's most recent introductions, and a large new shop has been erected for its manufacture. In the Hopkinson purifier, an outstanding feature is the positive washing of the oil which greatly assists the removal of fibres, colloidal carbon, and acidity. The heavy particles are deposited

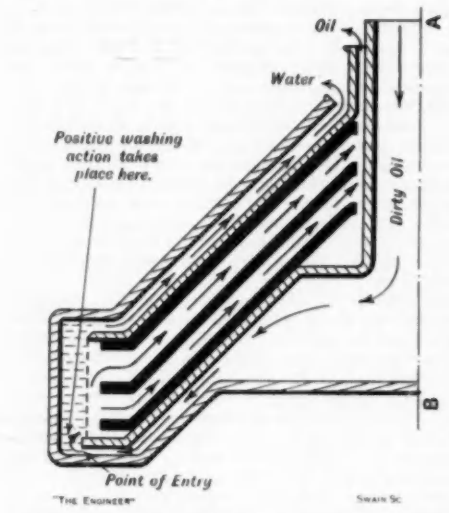


FIG. 13—PART SECTION OF OIL PURIFIER DRUM

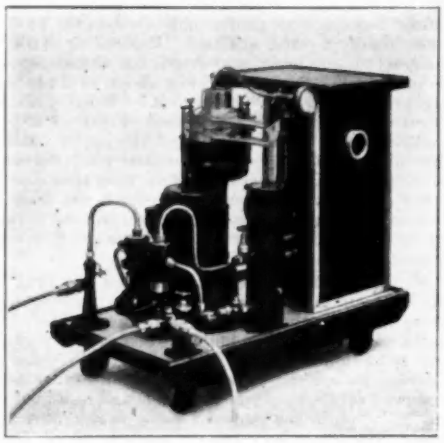


FIG. 14—PORTABLE OIL PURIFIER

on the side of the drum, and the lighter impurities, on reaching the water, are saturated so that their weight is increased and they are driven by centrifugal action to the walls of the drum, together with the dirt. The washing action dissolves the acids which are discharged from the drum by a small constant flow of water or by renewing the water seal at intervals.

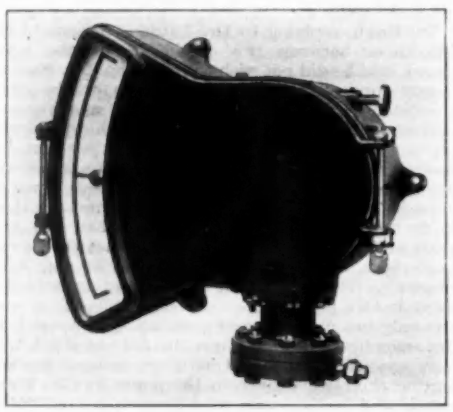


FIG. 15—STANDARD CRITICAL PRESSURE GAUGE

As the intensity of centrifugal force is dependent on the speed of the drum, any reduction in speed will adversely affect the efficiency of purification and to obviate that, belt driving is eliminated by the use of a self-contained electric motor drive. The power in this machine is transmitted from the motor by a pair of helical gear wheels. Pumps, when fitted, are also gear driven from the same motor, and a centrifugal clutch is used to minimise the driving stress on the motor during the acceleration period. The gears are enclosed in an oil chamber and are lubricated by oil mist, while ball bearings are fitted to take both the thrust and radial loads. The speed of the drum can readily be checked by a simple speed counter operated from the drum spindle. A stationary machine with one pump is shown in Fig. 12, and it will be observed that collecting trays surround the drum. These trays are provided with three spouts. The water and dirt escape through the bottom spout, the clean oil through the middle spout, while a top spout is provided in case the oil is fed to the machine more rapidly than the machine can deal with it, or lest from any cause the drum should become choked. On the top of the

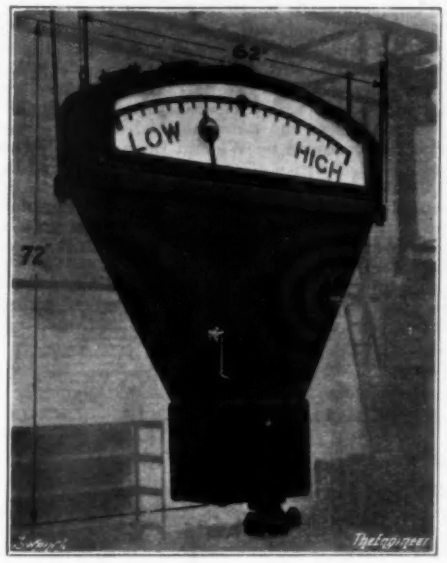


FIG. 16—LARGE CRITICAL PRESSURE GAUGE

three trays is a nipple through which the oil is fed to the drum. Fig. 14 shows a portable machine in which the purifier and all accessories, including an electric heater, are mounted on a metal covered trolley. Thermometer control is provided in the heating chamber to prevent excessive heating of the oil and to provide automatic temperature control, so as to enable the machine to run for long periods with the minimum of attention.

The most vital part of the apparatus is the drum itself and in the Hopkinson machine a radical departure from previous practice has been made. It is made of nickel-chrome steel and is dynamically and statically balanced. Referring to the diagram, Fig. 13, it will be seen that following the lines of arrows, the dirty oil flows down the centre tube and under an extended

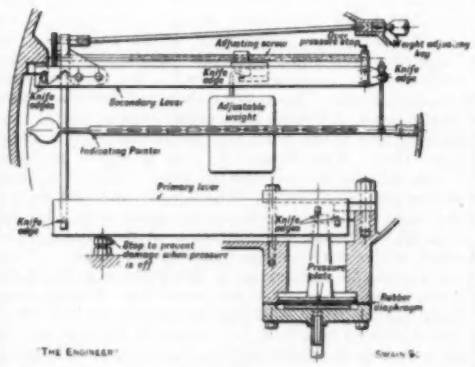


FIG. 17—CRITICAL PRESSURE GAUGE MECHANISM

skirt at the base, terminating at a point near the wall of the drum. The extreme edge of the skirt is so designed that when the drum is revolving, it is submerged in a vertical bank of water, which is called the water seal. By this arrangement the oil can only return to the centre by passing through this seal. This definite washing action is responsible for the removal of microscopic and hygroscopic fibres which are known to be the cause of rapid and serious reduction in the electrical breakdown valve of insulating oils. This is a patented feature of the Hopkinson centrifuge. These centrifugal machines run remarkably quietly.

Critical Pressure Gauge.

In order to indicate immediately comparatively small alterations in either furnace or steam demand conditions in the boiler-house, Messrs. Hopkinson make a critical pressure gauge which cuts out the lag between combustion control and steam demand. It indicates on an illuminated dial in fractions of a pound the pressure variations above or below the normal, thus affording to the boiler attendant the opportunity to make adjustments in the rate of combustion before the conditions have altered sufficiently to necessitate excessive correction and a wavy steam pressure chart. The instrument is shown in Figs. 15–17, the details of construction being given in the drawing—Fig. 17. Fig. 15 shows the standard type and Fig. 16 the large pattern. The appliance is made

FIG. 18—ELECTRICALLY-CONTROLLED VALVE

with either a single or double dial, that shown being the double dial type, arranged to hang from the roof. The scales are 18in. long and are marked on opal glass illuminated from behind. The centre mark on the scales represents the normal working pressure. This can be adjusted by means of the weight adjusting key shown in the drawing. The scale on either side of the centre normal pressure mark can be arranged to indicate anything from 5 lb. per square inch upwards and below normal working pressure, according to the degree of sensitiveness required, which is usually governed by whether the plant is a high or low-pressure one. The principle of construction is that of a weight-loaded diaphragm. The fluid pressure on the diaphragm is balanced by a system of weighted levers similar to a weighing machine. The movement of the diaphragm—which is only about 0·008in. for the full scale reading—is transmitted to the pointer through the leverage system shown. Arrangements are made so that the weight can be adjusted by means of a key from the outside of the case, which

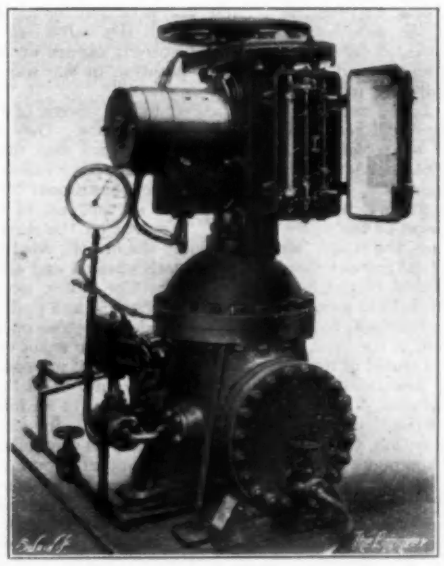


FIG. 19—ELECTRIC BY-PASS VALVE

enables the pointer to be brought to the central mark on the scale at any pressure, when any rise or fall in pressure is instantly noticeable.

Electrically Controlled Valves.

The electrical operation of large steam valves in modern power stations is making much headway owing to the increasing sizes of boilers and high steam pressures. Messrs. Hopkinson have devoted considerable attention to this class of valve, two varieties

of which are illustrated in Figs. 18 and 19. The valve control gear is a self-contained unit adapted to fit any standard valve with slight modifications and can also be supplied as a floor column—Fig. 20. The drive is through a hobbed worm reducing gear running in an oil bath. The reducing gear, together with the electrical and mechanical details, are completely enclosed in the water-tight case of the unit on which the operating motor is mounted. The motor has been designed for the purpose and possesses special characteristics in the way of high static torque and great overload capacity for a short period. The armature is mounted on ball bearings and the frame is totally enclosed. The drive is taken from the worm reducing gear through an automatic positive clutch, which is electro-magnetically controlled by the speed of the motor.

With this arrangement the motor attains full speed before being connected to the drive, the result being a hammer blow when the clutch takes up the drive, which effectually overcomes any tendency of the valve to stick or stall the motor. Control units in which the motor is connected permanently to the drive without the use of a clutch and those employing a centrifugal clutch, are at a disadvantage as, in the first case, the motor is apt to be stalled before it can start the valve from its seat, and in the other case, the stored-up energy in the revolving armature is dissipated in the friction clutch when the motor takes up the drive. The clutch consists of a massive nickel chrome heat-treated steel bolt, which is brought into action by means of an electric magnet when the motor has attained the correct speed. To ensure that the clutch under the most severe conditions cannot be forced out of engagement and at the same time

FIG. 20—FLOOR COLUMN VALVE

to make certain of its disengagement when the limit switches operate, provision is made to lock the clutch positively in engagement until the current is cut off, either by the opening of the limit switches or operation of the control station.

A special feature of these valves is that by the aid of the automatic magnetic clutch the valve can be operated by hand in case of current failure at any time without any special preparation in the way of clutching in the hand gear.

Limit switches are embodied in the design of the electrical gear and are not separate units. They are of a special quick-acting type and are also fitted with magnetic blow-outs, thus ensuring satisfactory operation under the most severe conditions. The limit switches come into action at the end of the travel of the valve spindle. They cut off the current from the motor, and also release the clutch, resulting in the instant stoppage of the valve travel and allow of the motor coasting to rest. The quick action of the limit switches is entirely mechanical and positive and not due to any spring trigger device. The operation of the limit switch is claimed to be so exact that the travel of the valve spindle can be set, if necessary, to less than $^1/_{64}$in. variation in amount. The limit switches do not prevent the valve, when in an intermediate position, from being operated in either direction, therefore the valve is equally as controllable when operated electrically as when operated by hand.

Messrs. Hopkinson have developed a complete range of apparatus for the remote control of their units, comprising push-button stations for complete control with lamp or dial-pattern position indicators, push-button emergency closing stations with patented hold-in details, and contactor panels for use with the push-button station. They also supply, instead of push-button stations, a small reversible controller when circumstances permit.

THE Nipawin Bridge, spanning the Sasketchewan River about 75 miles east of Prince Albert, has been completed. This bridge, which was built for the Canadian Pacific Railway at a cost of approximately 2,000,000 dollars, is 1907ft. long, and in addition to serving the railway, has a lower deck with a 16ft. highway for vehicular traffic, designed for 15-ton loading.

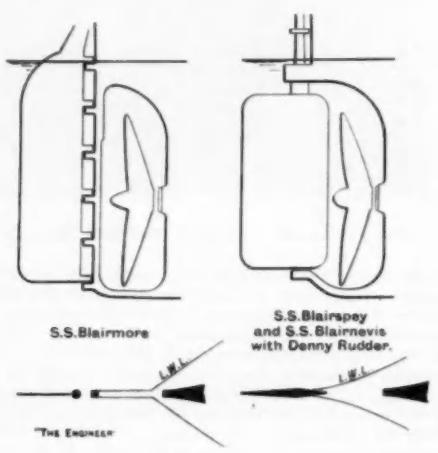
Summer Meeting of the Institution of Naval Architects.

No. II.*

WE continue below our account of the first meeting for the reading of papers, which was held in the Town Hall, Liverpool, on the morning of Tuesday, July 15th. We open our report with the third paper taken at that session.

SHIP PERFORMANCE AND RUDDER EFFECT.

In this paper by Mr. W. H. Woolnough and Dr. A. M. Robb, the authors gave trial trip particulars of three ships, which are similar in all respects except as regards the rudders, stern frames and propellers. All of them have a length of 370ft., a 51ft. beam, and a 22ft. 6in. draught, with a block coefficient of 0·7623. The trial trip performance of each ship was indicated by curves. The first of the three ships, the "Blairmore," has an ordinary stern frame and rudder, while the two later ships, the "Blairspey" and "Blairnevis," have rudders of the semi-balanced diamond-shaped type, as developed by William Denny and Brothers, Ltd. In these two ships the propellers were increased in diameter, pitch and surface, and the blade sections were slightly more bullnosed. On the "Blairmore" the upper after water lines were finished on a flat plate over the propeller, while in the two later boats they were slightly filled out over the aperture. The two different arrangements are shown in the drawing reproduced below. The powers recorded during the various trials and the indicator cards



taken were carefully checked, and the speed-I.H.P. curves were slightly corrected in view of experimental results obtained with the model at the Dumbarton tank. From the amended curves it was found that at 10·5 knots the "Blairmore" required 1375 I.H.P. instead of the 1109 I.H.P. of the "Blairnevis," while for 1780 I.H.P. the speed of the "Blairmore" was 10·93 knots, compared with 11·56 knots for the "Blairnevis." Figures for the "Blairspey" were not available for comparison, owing to adverse trial circumstances. The results obtained were analysed on the basis of Froude's propeller curves, and a comparison was made with the performance of another ship, the "War Shamrock," at a speed of 10·45 knots, also an analysis was made by means of Taylor's earlier propeller curves. The figures obtained showed the same tendencies to a smaller wake, a smaller real slip, and reduced augmentation of resistance as an effect of the modification made to the rudder. From the results it seemed as if the rudder post of the "Blairmore" prevented the water from flowing away from the propeller, and that the increased slip which was involved resulted in increased suction at the after end of the ship. It was further found that the thrust necessary to propel the "Blairmore" was 27½ per cent. greater than that necessary to propel the "Blairnevis." Even allowing for a slightly better mechanical efficiency in the case of the "Blairnevis" compared with the "Blairmore," and for differences in docking, there appeared to be considerable difference in the thrust required, which the authors consider is to be directly attributed to the difference in the design and arrangement of the stern frame and rudder in the different ships. The help of William Denny and Brothers, Ltd., and the permission of Geo. Nisbet and Co., Glasgow, to publish the results was acknowledged by the authors.

Mr. A. L. Ayre, who opened the discussion, was somewhat critical of the results of the trials as recorded in the paper. He did not doubt that the records of speed and revolutions were correct, but he doubted that the records of I.H.P. were accurate, because the indicator was a fickle instrument, and he appealed to engineers to produce an instrument which would tell the truth consistently. He did not think that the extent of the improvement given by the new rudder could be deduced from the records in the paper. The closer situation of propeller and rudder in the "Blairspey" and "Blairnevis," as compared with that of propeller and stern post in the "Blairmore," and the elimination of the usual space between the stern post and rudder, were bound to have effected improvement. The common but crude form of stern post and rudder, of which the "Blairmore" case was representative, could no longer be justified.

Mr. G. S. Baker said that the results obtained on the later boats with the Denny rudder were very much the same as his own experiments had shown might be expected. He had no doubt that the data obtained represented a fairly correct version of what had happened as the result of the changes made. The result was, however, that one of the ships, if it were to be made efficient, would have to be altered at considerable expense, which would have been rendered unnecessary if the experiments which Messrs. Denny had carried out after the ships had been built had been carried out at first. The authors had attributed the gains to the rudder, but, in his opinion, the changes they had made in the shape of the stern over the top of the rudder had contributed quite definitely to those gains.

Dr. John Tutin said that the comparative measured mile data for the three vessels were of special interest. They indicated that the "Blairnevis" with the Denny rudder required about 20 per cent. less I.H.P. than the "Blairmore," fitted with the ordinary rudder, to attain the same speed of 10·05 knots. That was a very remarkable improvement, and was particularly striking because the Denny rudder was not, strictly speaking, a stream-line rudder. The section was diamond-shaped. That figure of 20 per cent. was so large, however, that it prompted the closest scrutiny of the trial data and the subsequent analysis. In Messrs. Denny's report the view was expressed that the absolute value of the efficiency for the "Blairmore" was somewhat low, even taking into account the fact that the vessel had a square stern post, and that on the basis of I.H.P. the efficiency was only of the order of 52 per cent., whereas a common figure was some 10 per cent. higher than that. Therefore, said, Dr. Tutin, there was strong support for the conclusion that the "Blairmore" I.H.P. was about 10 per cent. too high. Applying this correction, the "Blairnevis" was still 9·9 per cent. better than the "Blairmore," a much more probable figure than the 19·3 per cent. found by the authors. Proceeding with the analysis on the basis mentioned, the thrust required to propel the "Blairmore" was about 10·1 per cent. greater than for the "Blairnevis." This, again, was more rational than the increased thrust of 27½ per cent. returned by the analysis in the paper. Making due allowance for propeller differences, degree of fouling and trim, it was probable that the improvement due to the rudder was about 6 per cent. A rudder of stream-line or reaction section, as opposed to the diamond type section, could be relied upon to improve on that figure materially.

Mr. H. A. M. Napier recalled that his firm had fitted stream-line rudders to three ships built seventeen years ago, which had to do 18 knots in either direction, and a very great success had been achieved as regarded the reduction in power for the steering gear and increase in speed. It was a type of rudder which deserved very careful consideration, and he added that the inclusion in the paper of some results of turning trials, indicating how the ordinary type of rudder compared with the semi-balanced stream-line rudder, would have been valuable.

Professor T. B. Abell—who preferred to deal in a written communication, to be submitted later, with the details of the paper—said that although at first he had been rather pessimistic about the results given, he had received particulars from Dr. Robb, and on analysis of the problems he was satisfied that, at any rate, there was very good ground for the claim made in the paper. Indeed, he claimed some credit for having pressed Dr. Robb to place the results before the Institution.

Dr. Robb, replying to Dr. Tutin's criticism of the differences between the conditions of the boats tested, said he did not wish to state what Mr. Maurice Denny's investigations had shown to be the effect of docking the "Blairnevis," but it was his considered opinion that the benefit due to that particular type of rudder was in the region of 15 per cent. It was not reasonable to put forward against a considered statement the suggestion that the recorded powers must be wrong, just because one could not get them to fit one's figures. Mr. Woolnough had put in a great deal of work to satisfy himself that the powers were right, and the figures could not be cast aside so easily. There had been no reasoned argument to show that the powers recorded were wrong. They were certainly inconvenient and amazing, but, apart from the amendments in the paper, he did not think they were seriously in error. One of the reasons for presenting the results given in the paper by Mr. Woolnough and himself was to suggest one method by which a discrepancy between tank predictions and actual results could be overcome. Their suggestion was that in the past the effect of appendages had been very seriously underestimated. None of the criticisms made had seriously affected the suggestion that there was something in the region of not less than 10 per cent., and not more than 15 per cent. difference in power required, owing to the stern frame alone. Professor Abell's figure was 12½ per cent., which was much bigger than anyone would have expected.

* No. I. appeared July 18th.

The meeting then adjourned until Thursday morning, July 17th.

The second meeting for the reading of papers was held in the Lecture Hall of the Central Technical School, Byrom-street, Liverpool, on Thursday morning, July 17th, the President, Admiral of the Fleet Lord Wester Wemyss, in the chair.

A satisfactory state of affairs with regard to membership was reported by the secretary, Mr. R. W. Dana, when announcing the transfer of a number of associate members and others to higher grades of membership and the election of a number of new members, associate members, associates and students. He stated that the numbers elected—including those elected at the Spring and Summer Meetings—represented a very definite increase of about seventy net for the first time in five years, after accounting for deaths and resignations.

Cargo Ships and Dock Equipment.

In a paper presented by Mr. R. T. Wilton, M.A., M. Inst. C.E., the Associate Professor of Dock and Harbour Engineering at Liverpool University, the effect of growth of size of cargo ships on docks and their equipment was dealt with, with particular reference to the Liverpool docks. The author dealt with his subject in decennial periods from 1880 to the present day. As an example of 1882 practice, the Albert Dock was taken as typical, although it was constructed in 1845. The Alexandra Dock was typical of 1890, the Canada Dock of 1900 and the Huskisson Dock system before and after the installation of hydraulic and electric cranes was taken for the 1910 and 1920 periods. The Gladstone Dock was considered as being representative of the most recent practice, and its features were dealt with in considerable detail. Some interesting comparative figures were given for the docks above referred to. With regard to the crane equipment and the transit shed of the Gladstone Dock, we may refer our readers to our description of April 8th, 1927, and to previous articles on the Gladstone Docks. The author showed that the effect of the increased size of cargo carriers on the transit sheds and their equipment, was to require a greater accommodation for cargo per foot run of quay, in order to enable it to be dealt with more conveniently. That meant a larger floor area of transit sheds, and also a more rapid discharge per hatch per hour, involving a larger equipment of more rapidly operating cranes, if shore equipment was to be relied upon to any great extent for cargo handling. If that greater speed of cargo handling per hatch per hour was not attained, then the period of discharge of the larger more modern vessels would be greater than that for the smaller vessels of former days, so that the increased size of vessel would be discounted to some extent by delays in discharging and loading cargo.

Mr. W. J. Willett Bruce, opening the discussion, referred to the attractive and economical system embodied in the Gladstone Dock, where the cranes lifted the cargo directly from the holds into the sheds, whereas previously it had been necessary to lift the cargo from the holds and place it on deck, and then to pick it up again by means of the roof cranes on land. The result of that improvement was to reduce the number of men required to deal with the cargoes of some of the larger steamers by as many as fifty or sixty per ship. Another advantage was that a good deal of overtime, which was at one time frequently necessary in order to enable a ship to keep to her schedule, was eliminated, and economies were also effected because less steam had to be maintained in the vessels themselves. As a result, a saving of 120 tons of coal per week had been effected in the ships on the Canadian and New York services. There were other advantages resulting from the facilities at Gladstone Dock, but it was difficult to calculate them exactly. For example, by reason of the magnificent lock at Gladstone Dock, steamers could come up an hour or two after high water, discharge their passengers at the landing stage, and then proceed into the dock the same evening, thus saving the wages and living of the crew for a day and probably reducing overtime during discharge and loading. Hydraulic ram shores had also resulted in savings in costs. When they were first used—at the time of the opening of the Gladstone Dock—there had been difficulties with the shipwrights, who had carried out the shoring previously, but the matter was settled by discussion between their representatives and those of the Dock Board.

Sir John Biles was concerned about the necessity for providing adequate depths in the docks and the entrances thereto. Some years ago he had ventured to suggest to the Dominions Royal Commission, which was very much interested in the future of ships, that a ship 1000ft. long and drawing nearly 60ft. of water, might be possible in the future. Some people had said that that was more or less an airy fancy, and some of the dock authorities had questioned it. When the question of constructing a tunnel under the Thames was brought forward, however, that matter of the draught of ships had to be much more seriously considered, and Dr. Robb and himself had re-studied carefully the papers they had examined at the time of the Dominions Royal Commission. After reviewing the whole subject, they had come to the conclusion that in the future—they could not say how near—the most economical ship would be one drawing 60ft. of water, and the only two limitations in regard to that development were (1) the provision of sufficient markets to ensure that such ships would have sufficient cargo to carry, and (2) the depth of water in the docks and harbours and in the entrances thereto. Another matter to be considered was the amount of cargo that could be turned out of a ship per hour. If the size of a ship were increased by increasing her draught, her capacity was increased in the ratio of the cube of the increase of the draught, so that whereas ships to-day were discharging 10,000 or 15,000 tons of cargo, ships of the size which he had indicated as being the most economical would carry 70,000 or 80,000 tons of cargo. Whilst acknowledging that Liverpool was well to the front in the matter of depths of water at the docks, he urged that the future draughts of ships were not by any means limited to the provision made to-day either in this country or abroad.

Mr. A. T. Wall discussed the economies which would be effected by equipping docks, so that it would not be necessary for cargo ships to carry a great deal of plant for the handling of cargo. If all the docks were able to deal with the cargo, then the time might come when at least many ships would be able to operate practically without cargo gear at all, with very obvious advantages. He asked if Mr. Wilton had any suggestions to make with regard to the improvement of the ships themselves to facilitate the handling of cargo.

Mr. Wilton, whilst appreciative of Sir John Biles' reference to the future, said the idea of providing appliances for unloading 70,000 tons of cargo from a vessel within a length of about 1000ft. might horrify dock engineers, but no doubt they would rise to the occasion, just as naval architects would in connection with the building of the ships.

In reply to Mr. Wall, he said he supposed the ideal was that the hatches should extend the whole length of the ship, in order that there should be ample room for putting tackle into the hold, but that was obviously impossible, and there must be a compromise.

Virtual Mass of Ship Models.

In a note on the direct measurement of the virtual mass of ship models, Professor T. B. Abell defined the virtual mass of a ship as that mass which, moving with the same velocity as the ship, has a kinetic energy equal to the sum of the kinetic energies of the ship's own mass and of the water set in motion by the ship. Alternatively it is the mass accelerated by the propeller thrust when the ship is acquiring speed from rest. Froude, in the 'seventies, determined the virtual mass of the "Greyhound" by differentiating the time-distance curve obtained after the tow of the "Active" had been cast off. At a displacement of 1160 tons he found that the virtual mass was 20 per cent. greater than the mass of the ship. Since Froude's time various other experimenters have employed the same or other methods for measuring the virtual mass of bodies moving in water or in air. Professor Abell has devised an experimental method for measuring the virtual mass of ship models based on a direct measurement of the acceleration produced by a known force. His means of measuring the acceleration consists of a differential pendulum, namely, a short-period pendulum swung from a platform fixed to a long-period pendulum. The short-period pendulum by its deflection measures the translational acceleration of the ship, the function of the long-period pendulum being to eliminate the acceleration caused by the pitching motion of the vessel.

Mr. G. S. Baker (National Physical Laboratory), opening the discussion, suggested that it was rather a fluke that the percentage which the author had obtained agreed very closely with the percentage obtained by W. Froude for the "Greyhound." It was known that friction extended the whole length of a body, and it added quite considerably to the virtual mass of the hull; it was also known that the equation of motion had not quite the simple form which Professor Abell had given in the paper, but that it consisted of an integral containing terms $U\frac{du}{dx}+V\frac{du}{dy}+W\frac{du}{dz}$; the secondary terms had no value when U, V and W were zero, but when the latter had a real value the secondary terms also had a value. He believed that Professor Abell ought to find, when he came to apply those figures, that the virtual mass was different from that obtained in his experiments described in the paper. In that connection he asked whether Professor Abell had tried determining the virtual mass of the body when it was reversed, because the result of reversing the body was to make eddies.

Mr. J. Denholm Young made two suggestions as to the purposes for which the apparatus mentioned in the paper might be used. In the first place, he pointed to the continuous pulsating effect of the engines, stroke by stroke, on a river steamer—say, a paddle steamer, in which the hull was light and the engines heavy—especially in the case of diagonal engines or some of those fitted with only a single crank, and suggested that if the apparatus were fitted to such a steamer a visible effect might be registered. The displacement of the vessel and the reaction of the machinery being known, the resultant difference between calculated mass and virtual mass might be ascertainable.

Professor Abell, replying to Mr. Baker, said he had used the word "frictionless" in his definition because he had realised that he was attempting to measure a perfect fluid virtual mass which Professor Lamb had estimated from various geometrically shaped bodies. He was not at all clear about the action of friction. The friction belt was brought about by viscous action. When a ship was steaming at sea this frictional belt was in existence; he was not quite sure how small changes of speed would affect the velocities in the frictional belt; but, of course, it would affect them. Since the time element was involved in the effect requiring any change in the frictional belt, he did not think that in practice there would be any appreciable change in the mass of the frictional belt during small changes in the speed of the ship. He believed the bulk of the mass to be accelerated would be the true or the perfect fluid virtual mass. He did not attach any importance to the fact that the percentage value he had obtained with his model was similar to that obtained with the "Greyhound." Of course, in the "Greyhound" the frictional belt existed, and, in addition, the "Greyhound" was in a very different form. He had not reversed the model in order to see the effect on virtual mass, but he was not sure that there would be any eddy-making involved, because there was no velocity at the time of the reversal.

The Wind Resistance of Ships.

In a paper presented by Mr. G. Hughes, B.Sc., a record of systematic model tests carried out at the William Froude National Experimental Tank was given. Experiments were undertaken in order to investigate the wind force acting upon ships' superstructures with all directions of wind. The experiments were made in water and the results are presented in a non-dimensional form which is independent of the medium of experiment. The general application of the work was also considered. For the purpose of test three ships now in service for which sea data were available were taken, and models were made of the hulls and superstructures, which were tested separately and then together, by towing in the tank at various steady angles of relative wind and over a large range of speeds. For wind at an angle to the bow or stern the model was constrained to move through the water at the required angle under the action of three forces, which were adjusted to hold the model in equilibrium against the water resistance. The ship types chosen for experiment were the Eagle Oil Transport Company's oil tanker "San Gerardo," of 16,000 tons displacement and 10 knots speed; the Furness-Withy express cargo steamer "London Mariner," of 14,800 tons displacement and 14 knots speed; and the Cunard liner "Mauretania," of 38,000 tons displacement and 25 knots speed. In "still air" the percentage rates of air resistance to hull resistance in pounds was found to be 2·7, 2·7, and 2·1 per cent. respectively for the three models. Further experiments are to be made, including experiments in air corresponding exactly to those already made in water, as a check on the work already done. Model experiments have also been made on the ships' under-water forms corresponding to the models tested for wind resistance, and it is hoped to investigate the effects of wind on the steering and on engine power and revolutions.

Mr. J. L. Kent, who opened the discussion, suggested that the paper would be of practical use in connection with the problem of the steering of ships. He had crossed the Atlantic several times for the purpose of collecting data with regard to the propulsion of ships in various sorts of weather, and had formed the opinion that those vessels which tended to come up into the wind, if left to themselves, were much more easily steered than those which fell off the wind. Mr. Hughes' paper showed how to determine the line of action of wind resistance at an early stage of design. Some experiments were being carried out—and he hoped the results would be published in the future—on the lateral resistance of a ship, its centre of lateral resistance, and its line of action, and from the data obtained it would be possible to determine the turning moment of a ship quite simply in the very early stages of design. One appreciated that the superstructure of a ship could not be altered from time to time as required to make the ship come up into the wind. It was very necessary sometimes to consider the internal arrangements, and so on, but a better compromise might be made by a study of Mr. Hughes' paper, so that easy steering and therefore better propulsion would be possible.

Professor T. B. Abell, who regarded the paper as the most valuable the Institution had had on air resistance, pointed out at the same time that the measurements made by Mr. Hughes related to movement through still air. The paper contained data on the proportion of the air resistance to the total resistance, but the figures might need some correction for motion against the wind, because the velocity of the wind in the neighbourhood of the water surface was not uniform, but was smallest at the water level and increased as the height increased above the water surface. In order to draw attention to the real importance of air resistance, Professor Abell said that if the "San Gerardo" steamed at 10 knots into a wind of 20 knots, the author's figure of 2·7—representing percentage air resistance/hull water resistance—became 25 per cent. The relative wind was 30 knots; that increased the resistance as the square of the speed, which was nine times. Thus there

was obviously scope for a large amount of work for the purpose of determining how superstructures could be modified to reduce the air resistance. As the speed of the ship increased, curiously enough the percentage resistance decreased, and that indicated the importance of air resistance in the case of even a slow-speed ship. He congratulated Mr. Hughes upon his pioneer work on air resistance.

Mr. J. Hamilton Gibson recalled how a similar problem was tackled by the engineers responsible for the Forth Bridge some thirty or forty years ago. The superstructure of the bridge was to be exposed to the wind, and the problem was to ascertain what was the relative flat surface as compared with the very complicated girder structure, which was facing the wind, of course, at various angles, according to the direction at which the wind blew. The problem was attacked, however, and overcome successfully, and it occurred to him that a method somewhat similar to that applied in the case of the Forth Bridge might be applied in connection with ship structures. A scale model of a portion of the structure was made and mounted on the end of a long lath. At the other end of the lath there was a plain piece of plate, the shape of which could be altered in order to get the exact number of square inches or square feet. The lath was suspended at the centre from a long wire which was secured to the inside of a tall building, and the whole apparatus was allowed to swing forward. If the lath arrived at the other end of the hall without twist, it was assumed—and he supposed it was assumed correctly—that the area of the complicated model was practically the same as that of the square piece of plate. It was a simple and direct method of determining wind resistance, and it might be worth while applying it to ships' structures.

Mr. Hughes, replying to the discussion, said that the question of steering, mentioned by Mr. Kent, was one which might be taken up later. It had already been shown that the effect on steering resulting from an alteration of superstructure could be quite considerable. Replying to Professor Abell, he said the figures given in regard to the resistance to motion in still air were, of course, very approximate, and the data were approximate in the sense that one could not possibly determine the effect of wind on a ship with very great accuracy, simply because of the tremendous variation in the wind velocity, not only with the height above water, but the variation from moment to moment and also the variation in direction. The data were intended to be used, if they were used, with due regard to the practical limitations which must be taken into consideration when one considered an actual ship. With regard to the importance of wind resistance with higher wind velocities, he said that with relative wind velocities equal to twice the ship's speed, the percentage air resistance/hull water resistance became 10·8 for the "San Gerardo," 10·8 for the "London Mariner," and 8·4 for the "Mauretania." On the basis of absolute wind speeds of 60 knots, with each ship steaming directly ahead into the wind, the "San Gerardo" would be practically pulled up—the head resistance due to wind would be practically equal to the thrust which the propeller was capable of delivering to the ship—the speed of the "London Mariner" would be reduced from 14 to 8 knots, and that of the "Mauretania" from 25 to about 22 knots. The effect decreased, of course, with the actual size, speed and power of any ship for any given absolute wind.

Referring to the experiments mentioned by Mr. Hamilton Gibson, he said that such experiments must be made in air. The experiments referred to in the paper were made in water because bigger models could be used, and water experiments provided an easier method of obtaining the actual data by direct measurement.

The secretary, Mr. R. W. Dana, who was interested in this matter as one of the members of the Advisory Committee for the Tank, said that one of the difficulties of that Committee was to decide the order of importance of many of the subjects which were put forward for investigation at the Tank. The subject of wind resistance was one which had not been given very much consideration in the past, because there were so many other things before the Committee, but it was quite obvious to the layman that the enormous growth of superstructures had become such a feature of modern high-speed passenger vessels that the subject was very worthy of consideration, as proved by Mr. Hughes' paper. When the forms of superstructure were taken into consideration, obviously all the practical details had to be borne in mind, so that the efficiency of each vessel should not be diminished. Mr. Dana also commented upon the fact that the researches carried out in the experimental Tank had received a great deal of notice at that Liverpool meeting, as was appropriate, having regard to the great importance of the Tank work upon the industry of Liverpool. The Lord Mayor of Liverpool was most sympathetic in that matter, and there would be more support from the shipowners in the future, for unquestionably the Tank work was of the utmost value to them.

VISITS AND SOCIAL EVENTS.

On the afternoon of Tuesday, July 15th, the members of the party divided into two main groups and visited the Liverpool system of docks. Starting from the Prince's Landing Stage, the steam yacht "Galatea," belonging to the Mersey Docks and Harbour Board, and the tender s.s. "Skirmisher," of the Cunard Line, steamed down the Mersey and through the docks, one party visiting the Canadian Pacific liner "Duchess of Bedford" and the other the M.V. "Ulster Monarch," belonging to the Ulster Imperial Line. Alternative visits on Tuesday afternoon included one to the Garston match factory of Bryant and May, Ltd., and a visit to the Prescot works of the British Insulated Cables Company, Ltd. On the evening of Tuesday a reception was given by the Lord Mayor of Liverpool, Councillor Laurence D. Holt, and the Lady Mayoress, in the Town Hall, and there was dancing in the ballroom. Over four hundred members and guests attended and a very enjoyable evening was spent.

On Wednesday morning, July 16th, visits were paid to the Mersey Tunnel works, the new Liverpool Cathedral, and the P.P. Press, Ltd., at Court Hey, Broadgreen. In the afternoon a large party accepted the invitation of Lever Bros., Ltd., to visit Port Sunlight and to inspect the works. Tea was afterwards served in the Lady Lever Memorial Art Gallery. Several engineers travelled to Manchester and viewed at Trafford Park the works of the Metropolitan-Vickers Electrical Company, Ltd.

On Wednesday evening the summer meeting dinner took place at the Midland Adelphi Hotel, and over two hundred and twenty members, guests and ladies were present. The chair was taken by the President, Admiral of the Fleet Lord Wester Wemyss, who proposed the toast of "Success to the City and Port of Liverpool and the Health of the Lord Mayor and the City Corporation." In his reply the Lord Mayor, who had recently visited Hamburg, expressed his interest in Mr. Baker's appeal for the Teddington tank, and suggested that the work of the tank should not be neglected. He recalled, however, the fact that there was no better tank in the world than the ocean through which our ships passed, and suggested that the lessons which were there to be attentively and accumulatively learned were the best that life could bring. The Mayor of Birkenhead, Alderman Thomas McLellan, proposed the toast of "The Institution of Naval Architects," and Sir John Biles replied.

After the reading of papers on Thursday morning, July 17th, luncheon was served on board the Cunard liner "Franconia," where, in the absence of the chairman of the Cunard Line, Sir Percy Bates, the party was received by Mr. F. A. Bates, the joint deputy chairman. Another party visited the works of Cammell Laird and Co., Ltd., at Birkenhead, and were received by Mr. W. L. Hitchens, the chairman of the company, and Mr. R. S. Johnson, the managing director. The visitors were afterwards entertained at a luncheon at which Mr. Hitchens presided. In the evening the Blue Funnel Line gave a dinner on the s.s. "Patroclus," which was berthed in the Victoria Dock at Birkenhead, and a dinner and dance was also given by Ellerman Lines, Ltd., on board the s.s. "City of Hong Kong," which was berthed in the East Float at Birkenhead. On this vessel the guests were received by Mr. T. L. Princep, London director of Ellerman Lines, Ltd., and Mr. F. H. Southern, of Liverpool, a director of the Hall Line, and by Mr. W. Hinchcliffe, the superintendent engineer of the Ellerman Lines. Mr. W. H. McMenemy, the President of the Liverpool Engineering Society, in acknowledging the toast of "The Visitors," referred to the technical progress made by the Ellerman Lines, and three valuable comparative tests of steam engines, steam turbines and oil engines and of exhaust turbo-generator machinery which the company had made.

On the motor liner "Adda," belonging to the Elder Dempster Company, Ltd., a large party was also entertained to dinner. The guests were received by Mr. J. H. Sharrock, chairman of the Liverpool Board of the Elder Dempster Lines, and Mr. Picton H. Jones and Mr. S. D. Grundy, Liverpool directors.

On Friday, July 18th, an excursion was made to North Wales, which, in spite of somewhat inclement weather, was much enjoyed.

Altogether the 1930 Liverpool meeting must be looked upon as one of the most successful home meetings of recent years, and tribute must be paid to the work of Professor T. B. Abell and the joint Honorary Secretaries of the Reception Committee, Mr. F. W. Gasken and Dr. A. M. Robb, who, working in collaboration with Mr. R. W. Dana, made such pleasing technical and social arrangements and ensured such a generous and hospitable welcome to Liverpool.

The Royal Agricultural Show at Manchester.

No. IV. (*conclusion*).*

AVELING AND PORTER.

A FOUR-CYLINDER vertical oil engine giving 22·5 brake horse-power at 500 revolutions per minute and 50 brake horse-power at 1300 revolutions per minute, constructed under the Acro licence by Aveling and Porter, Ltd., Rochester, was shown in operation. The cylinders are 4¾in. bore by 6¾in. stroke and the weight of the engine, with aluminium alloy cylinder block, is, we are informed, 1000 lb. Some of the salient features of this engine are: a short close-coupled crank shaft with 3in. crank pins, dynamically balanced and supported in three heavy roller bearings; single helical gears of nitralloy steel; cylinders with removable centrifugally cast liners of chrome-nickel iron; a newly designed oil pressure pump delivering a supply of lubricant direct to the four crank pins from the timing end through the hollow crank shaft; and a new variable-speed governor. The valves are of the overhead pattern in the cylinder head working in removable guides made of centrifugally cast nickel iron. A Bosch fuel pump is used. It is a completely independent unit of the constant-stroke single plunger per cylinder type giving accurate measurement at all speeds and loads independent of the injection pressure, the control rod of the pump being suitably connected to the governor operating gear. A Bosch fuel injector, with single hole pintle type cone spray nozzles, delivers the oil into the combustion space. Starting is effected by a 6 horse-power electric motor and two 12-volt batteries which are charged by a dynamo directly driven at 1·3 engine speed by helical gears. The mild steel fly-wheel is housed in a separate casing attached to the cylinder block and accommodates either a multple disc or single plate clutch. A view of the engine showing the starting gear is given in Fig. 20.

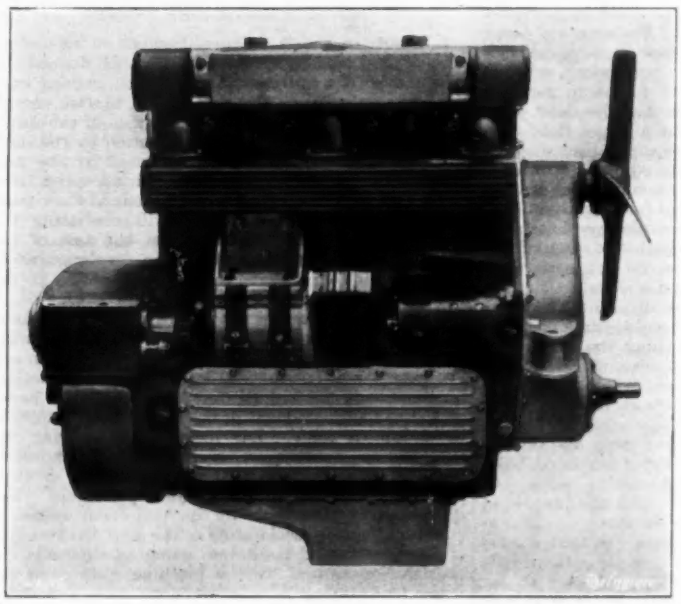


FIG. 20—INVICTA OIL ENGINE—AVELING AND PORTER

R. A. LISTER AND CO.

The most interesting exhibits on the stand of R. A. Lister and Co., Ltd., were, because of their comparatively recent introduction, heavy-oil engines from 5 to 44 B.H.P. and "Diesel-Lister" lighting plants. These new engines are built with single, twin, and four cylinders. We must refer our readers to THE ENGINEER of May 16th last for a detailed description of them, but may briefly mention here that it is in the arrangements for cold starting that the most novel feature is found. There is practically no clearance between the top of the piston and the cylinder head, but compression space is provided by a chamber above. This chamber has a tangential opening to the cylinder space to produce turbulence, and is fitted with a Bosch fuel injection valve supplied by a Bosch pump. Connected with this chamber there is a secondary chamber which increases the volume of the compression space by about one-half. The connecting passage has a simple screw-down valve that can be used to isolate the second chamber or be retracted away from the effect of the explosions in the cylinder. When the valve is screwed down on to its seating and the second chamber is cut off, the combustion space is such that the compression rises

* No. III. appeared July 18th.

to about 600 lb. per square inch, which is sufficient to ignite the charge even with a cold engine. When the engine is running, the valve is opened and the compression is reduced to the normal 400 lb. per square inch. The engine was designed by Mr. H. Ricardo.

Another of the exhibits on Messrs. Lister's stand was a 5-kilowatt automatic lighting set with fifty-two Tudor cells having a capacity of 150 ampère-hours when discharged at the ten-hour rate, namely, 15 ampères for ten hours. The set is started up when the load on the plant exceeds a predetermined figure, and as long as there is a load in excess of this on the plant the set continues to run. At first the battery is charged at a fairly heavy rate, but when it is nearly fully charged the rate falls to a very small figure, thus avoiding serious damage by overcharging. When the load on the plant falls below the predetermined figure, the engine shuts down and the battery takes the load. The set does not start up when the battery is fully discharged nor shut down when the battery is fully charged, the starting and shutting down being solely controlled by the current supplied by the plant. The battery is of the sealed type, which enables the cells to be sent by train, charged and full of acid without risk of spilling.

Davey, Paxman and Co., Ltd.

This Colchester firm was represented by a 70 to 77 B.H.P. twin-cylinder vertical heavy fuel oil engine, which is enclosed and fitted with pressure lubrication throughout. This engine is fitted with a system of spring injection made under licence from the patentees —Blackstone and Co., Ltd. —which enables the injection to take place at the same pressure and at the right moment, whatever the speed of the engine may be. The Paxman excentrically operated exhaust valve gear is already familiar to our readers. Whilst enabling use to be made of the quickest lifts of the valves, it prevents shock and thus lengthens the useful period of service before necessitating regrinding. The construction of the gear is such that removal of the valves takes a very short time, there being no cotters or powerful compression springs to contend with. The pressure of the lubricating oil is controllable by hand, and the speed of the engine is also under ready control either by the governor or by hand.

John Fowler and Co., Ltd.

The exhibits of this Leeds firm of engineers were more varied than usual. They included a 10-ton oil-engined road roller of the three-wheel type; a 5-ton motor road roller; a single-cylinder steam road roller with a modified Belpaire boiler and corrugated fire-box; concrete mixing machinery; an oil-driven winch and a three-furrow balanced subsoil plough. The principal new appliances shown on this stand were a 5-ton trailer on pneumatic tires, an improved scarifier, which is illustrated in Fig. 21, and a "Tractrailer" arranged for carrying 6 tons of logs on roadless tracks. The new scarifier, which was shown fitted to a steam road roller, embodies some unusual features. The depth of operation is regulated by a large hand wheel working through steel bevel gear on to a sliding member which carries the tool holder. The sides of the sliding member and tool holder are toughened steel castings. The adjustment is of the simplest form compatible with strength and ease of operation. Shock is absorbed by means of a special arrangement of springs situated in the sides of the sliding member, which alleviate the stresses on the tank plates and the scarifier body. The framework, being constructed of strong steel plates, is more flexible than a casting and assists in absorbing shock. Putting the tynes in and out of work is effected instantaneously by means of a weighted lever, at the rear of the scarifier, operating the swivelling tool holder. This is extremely useful in cases where the road has to be scarified around gates, manholes, &c., as the tynes can be lifted and lowered into work again immediately. The scarifier is automatic in operation, and when reversing it is not necessary to raise the tool holder, the tynes merely sliding back over the road surface in a similar manner to a pawl and setting themselves into work as soon as the forward motion of the roller begins. The working stresses are mainly taken up by the hind axle, where exceptional strength is available. The tines are adjusted and tightened by means of double wedges which are hammered up from the back of the scarifier. This arrangement of wedges allows the scarifier to be attached to the tender close to the hind roller, which ensures the tines following closely the contour of the road, a point of importance and one which will be readily appreciated. Bent tines can be extracted very easily from the rear of the scarifier, owing to the large opening for the double wedges. The method of attaching the Fowler scarifier to the tank side plate is interesting. The scarifier frame is flat on its edge and beds itself firmly to the tank plate, a hardwood packing piece assisting in relieving shock to the roller. In this arrangement it is claimed that the stresses are taken up by a much larger area of the tank side plate than is the case when the scarifier frame has lugs or feet, and consequently the possibility of cracked tank plates is reduced. The scarifier is stayed to the side of the fire-box shell and the hind axle wheel boss, whilst an additional stay from the tank bottom is bolted to the base of the scarifier frame.

The Fowler "Tractrailer" is fitted with "Orolo" track units and has been designed for the purpose of overcoming the difficulties experienced when using trailers with ordinary wheels on soft or uneven ground. The units are of the girder type and lock themselves to a predetermined radius. The novelty in connection with their design is that the stress due to the vertical load is completely removed from the track pins which hold the links together and the life of the track is thereby increased.

The method on which the track is constructed will be followed from the illustration—Fig. 22. It will be seen that minor stresses, due, for instance, to side-lying ground or to braking and turning movements, cannot be imposed on the pins. These stresses are accomodated by providing abutments or locking faces, of the cup and ball type, which, by their form, resist the stresses referred to when the track is in the locked position. In addition to the provisions already mentioned to prevent wear of the hinge pins further provision is made in the form of manganese steel bushes which are pressed into the castings and in which the fully floating hardended and ground pins work. The pins are prevented from endwise movement on the insides of the links by the castings themselves and on the outsides by split pins.

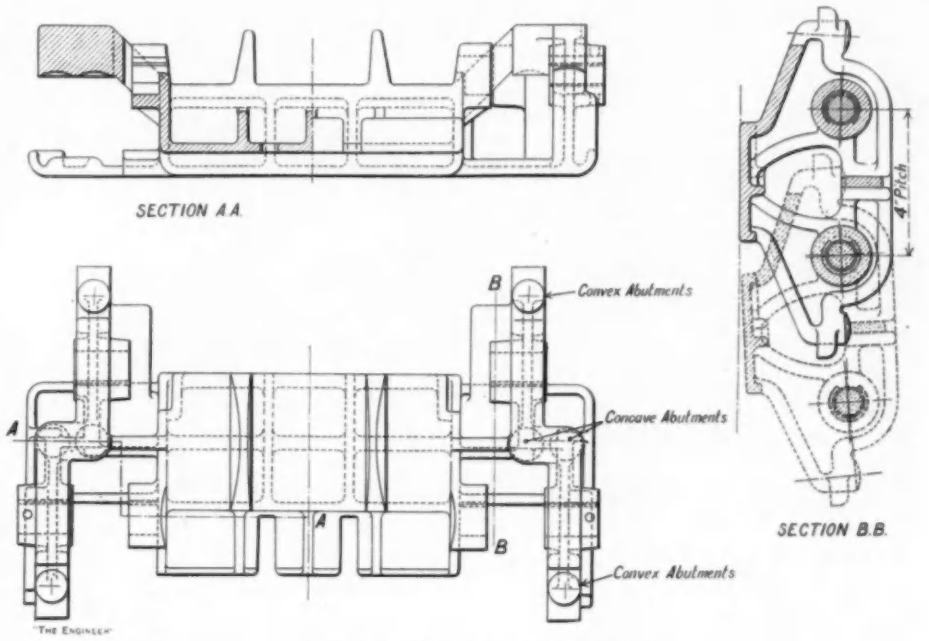


FIG. 22—THE "OROLO" TRACK UNIT

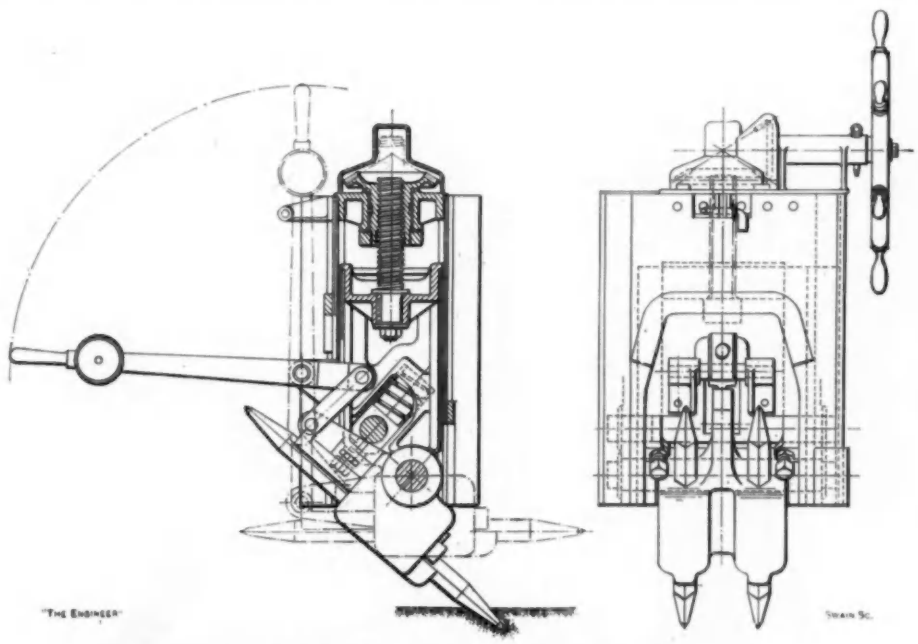


FIG. 21—SCARIFIER ON A ROAD ROLLER—FOWLER

Massey-Harris.

A tractor binder of all-steel construction was a prominent feature on the Massey-Harris stand. In this machine the possibility of the travelling wheel slipping, owing to choking or the bad state of the ground, is avoided, as the machine is simply carried on the wheels, the mechanism being operated by power transmitted from the tractor to the binder by a power-driven shaft. A grinding machine by the same makers is intended to be driven from a tractor. It is a high-speed machine in which Timken roller bearings are used to reduce friction and end thrust. The grinding is done by two metal plates, one stationary and the other revolving at a high speed. The stationary plate is bolted to the cover of the housing, which, in turn, is secured to the main housing by bolts, these being kept in alignment by a spider, so that the stationary plate can slide to or from the revolving plate freely. A feature of the Massey-Harris tractor is a patented U-shaped steel plate frame which combines in one piece the oil reservoir, crank case, transmission case, and the supporting frame for all the working parts. This frame prevents the leakage of oil from the engine, and the access of dust to the working parts. The engine is of the four-cylinder vertical pattern, with valves in the head and removable cylinder liners. It operates on paraffin or petrol, and the drive is taken through a clutch and gear-box containing a differential direct to the driving axle by spur gearing.

Fairbanks, Morse and Co.

This firm always provides a varied display of appliances of special interest to farmers and owners of estates. One of the most attractive exhibits at Manchester was a small electric light and power plant which is made in two sizes, namely, 750 watts and 1500 watts. The smaller plant has a 1½ H.P. engine with a cylinder 2¼in. bore by 3¼in. stroke, and gives its output at 1500 revolutions per minute, while the larger plant is rated at 3 H.P., has a cylinder 3⅛in. bore by 5in. stroke, and the running speed is 800 revolutions per minute. The engine is water-cooled in both cases, has high-tension magneto ignition, and the generator is mounted upon it, the drive being by means of a V-belt called the "Flex-Mor," with adjustment for stretch. The control is contained in a box attached as a unit to the main frame.

It consists of a simple push-button starter, and a "high-low-belt" switch for changing a battery. In one position the generator is electrically disconnected from the engine, leaving the entire power of the engine available for pulley work. The engine is self-oiling, the crank case serving as an oil reservoir. The smaller plant operates on petrol, but the larger plant is made to work on either petrol or paraffin. The voltage is either 32 or 115. On the same stand we noticed a new self-oiling power pump which is made in four sizes, suitable for lifts not greater than 22ft., and a total discharge head not exceeding 230ft. This pump is of the duplex piston type, giving a good mechanical balance. The water box and frame are cast in one piece and machined at a single setting. The crank shaft is fitted with oil splashers, by means of which oil is thrown into auxiliary reservoirs, which are connected by means of leaders to the main bearings, the surplus oil from which drains back into the crank case. The cylinders are of seamless drawn brass tubing, securely pressed into the water box, and there are four suction and four discharge valves of soft rubber on bronze seats. All the working parts are easily reached by removing the water box bonnet.

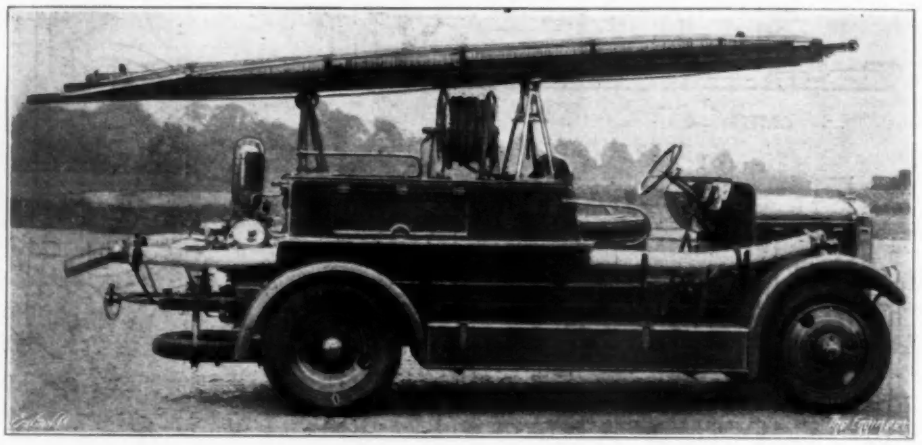


FIG. 23—MOTOR FIRE ENGINE—MERRYWEATHER

MOTOR VEHICLES.

No Royal Show would now be complete without a display of motor lorries and omnibuses, and this year some of the principal makers showed their most recent types. John I. Thornycroft and Co., Ltd., Chiswick, showed a 26-seater saloon omnibus on a rigid six-wheeled, six-cylinder chassis; Bean Cars, Ltd., Tipton, showed a sun saloon coach as well as commercial vehicles; the Vulcan Motor and Engineering Company, Ltd., Southport, was represented by both passenger and goods-carrying vehicles; Leyland Motors, Ltd., Leyland, in addition to four and six-cylinder omnibuses, exhibited a 70-cwt. lorry fitted with the Scania-Vabis hydraulic tipping gear, which is operated from the gear-box and enables the platform to be tilted on either side or endwise, a very neat arrangement; the Albion Motor Car Company, Ltd., Glasgow, exhibited a 30-cwt. van, a 5-ton lorry, and a 32-seater omnibus with a 36–90 horse-power engine; Crossley coaches were shown by Charles Roberts and Co., Ltd., Horbury Junction, near Wakefield; Morris Commercial Cars, Ltd., Birmingham, showed commercial vehicles, a fire-engine, and a 32-seater omnibus; and other exhibitors in this section included Dennis Brothers, Guildford; Willys Overland, Crossley, Ltd., Stockport; the Associated Equipment Company, Ltd., Southall, Middlesex; Dodge Brothers, Ltd., Park Royal; and Lookers, Ltd., Manchester. To Merryweather and Sons, Ltd., Greenwich-road, S.E., the protection of the highly combustible contents of the showyard was entrusted, as usual. For fire-extinguishing purposes the firm had on the ground a motor fire-engine—Fig. 23—on pneumatic tires, capable of pumping 275 gallons per minute, and propelled by a petrol motor of 35–40 horse-power; two trailer fire pumps with a petrol motor of 20 and 40 horse-power, and capable of delivering up to 275 gallons per minute; and a portable steam fire and pumping engine to deliver 200 gallons per minute, and capable of burning almost any combustible material.

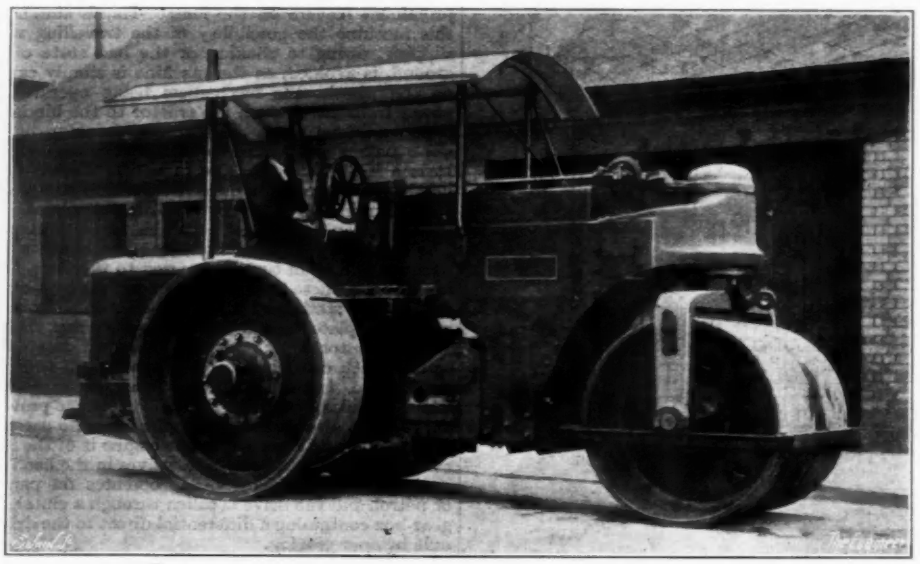


FIG. 24—MOTOR ROAD ROLLER—BARFORD AND PERKINS

OIL-ENGINED ROAD ROLLER.

A recent development in motor road rollers was shown in the machinery-in-motion section by Barford and Perkins, Ltd., Peterborough. An illustration of this machine is given in Fig. 24. It has as a power unit a 32–35 B.H.P., two-cylinder oil engine, mounted together with the gear-box in a sub-frame which provides ease of accessibility and brings the centre of gravity down below the axle line. Three speeds of approximately 3¾, 2¼, and 1¼ miles per hour are available in both directions, and there are quick reverse clutches operated by a separate hand lever. All gearing is enclosed and runs in an oil bath and steering is by means of a worm and quadrant. The weight of the machine fully loaded is 12½ tons. There is a sprinkling water tank and sprinklers to the front and rear rolling wheels, and a two-tine scarifier. We are informed that the working expense for fuel is approximately 2½d. per hour.

DURING the week of February 10th to 14th, 1931, Chicago is to hold its Fifth Mid-West Power Engineering Conference, and, immediately following, at the same headquarters, the Fourth National Fuels Meeting of the American Society of Mechanical Engineers. The Fifth Mid-western Engineering and Power Exhibition will be held during the same week at the Coliseum.

The Institute of Metals.

THE Autumn Meeting of the Institute of Metals will be held at Southampton from September 9th to 12th. Following the meeting a week-end trip to France will be made. The following programme has been arranged:—

Tuesday, September 9th.—8 p.m.: Ninth Autumn Lecture by Professor D. Hanson, D.Sc., Vice-president, on "The Use of Non-ferrous Metals in the Aeronautical Industry," in the Chantry Hall, Chapel-road.

Wednesday, September 10th.—9.30 a.m.: General meeting of members in the Chantry Hall, Chapel-road. Papers Nos. 539, 531, 530, 536, 533, 534, and 535 will be presented in abstract and discussed as time permits. 2 p.m.: Visits to (*a*) Portsmouth Dockyard, (*b*) Romsey Abbey and Winchester, (*c*) Supermarine Aviation Works, Hythe and Woolston, (*d*) Ordnance Survey Office, Southampton. 8.30 p.m. to midnight: Reception and dance in the Royal Pier Pavilion.

Thursday, September 11th.—9 a.m.: General meeting of members at the Chantry Hall, Chapel-road. Papers Nos. 541, 542, 543, 544, 532, 537, 529, and 540 will be presented in abstract and discussed as time permits. 2.30 p.m.: Visits to (*a*) R.M.S. "Mauretania," followed by visits to Floating Dock and International Cold Storage and Ice Company, Ltd., or Floating Dock and Harland and Wolff, Ltd. (tea will be provided); (*b*) John I. Thornycroft and Co., Ltd., Shipyard, Woolston (tea will be provided); (*c*) Ordnance Survey office; (*d*) Romsey Abbey and Winchester. 7.30 p.m.: Visit to the Empire Theatre.

Friday, September 12th.—A choice of two all-day excursions is offered:—(*a*) A motor trip in the New Forest; (*b*) a motor trip round the Isle of Wight.

Papers.—The following papers are expected to be submitted:—

D. A. N. Sandifer, M.Sc., "Pendulum Hardness Tests of Commercially Pure Metals." (529).

J. D. Grogan, B.A., "Pressure Die Cast Aluminium Alloy Test Pieces." (530).

W. Rosenhain, D.Sc., F. Inst. Met., F.R.S., J. D. Grogan, B.A., and T. H. Schofield, M.Sc., "Gas Removal and Grain Refinement of Aluminium Alloys." (531).

H. C. Dews, "The Effects of Phosphorus on the Strength of Admiralty Gun-metal." (532).

K. L. Meissner, Dr.-Ing., "The Artificial Ageing of Duralumin and Super-duralumin." (533).

W. L. Fink, M.S., Ph.D., and K. R. von Horn, M.S., Ph.D., "Lattice Distortion as a Factor in the Hardening of Metals." (534).

Marie L. V. Gayler, D.Sc., "A Study of the Relation between Macro and Micro-structure in some Non-ferrous Alloys." (535).

N. W. Ageew, Met. Eng., and Olga I. Vher, Min. Eng., "The Diffusion of Aluminium into Iron." (536).

D. Stockdale, M.A., Ph.D., "A Note on the Constitution of the Cadmium-zinc Alloys." (537).

Geh. Reg.-Rat. Professor Dr. G. Tammann, "On the Determination of Crystallite Orientation." (538).

Ernest A. Smith, A.R.S.M., "Rolled Gold: Its Origin and Development." (539).

F. Hargreaves, A.R.S.M., D.I.C., "Heat Treatment, Ball Hardness and Allotropy of Lead." (540).

J. C. Hudson, D.Sc., D.I.C., A.R.C.S., "The Effect of Two Years' Atmospheric Exposure on the Breaking Load of Hard-drawn Non-ferrous Wires." (541).

W. H. J. Vernon, D.Sc., Ph.D., and L. Whitby, M.Sc., "The Open-air Corrosion of Copper. Part II.: The Mineralogical Relationships of Corrosion Products." (542).

E. Voce, M.Sc., Ph.D., "Silicon-copper Alloys and Silicon-manganese-copper Alloys." (543).

E. Vaders, "A New Silicon-zinc-copper Alloy." (544).

B.E.S.A. SPECIFICATIONS.

CARBON FILAMENT GLOW LAMPS.

The British Engineering Standards Association has just revised the British Standard Specification No. 33–1906 for Carbon Filament Glow Lamps. This specification has been brought into line with Specification No. 161 for Tungsten Filament Lamps. The clauses in the two specifications correspond, and the lamps are now rated in lumens instead of candles. Copies of this B.S. Specification No. 33–1930 may be obtained from the British Engineering Standards Association, Publications Department, 28, Victoria-street, London, S.W. 1, price 2s. 2d. post free.

NON-FERROUS METALS.

The British Engineering Standards Association has recently issued five new British standard specifications for non-ferrous metals. Two of them, Nos. 382 and 383, deal with 2/10/88 Bronze (Gun-metal) Ingots and Castings respectively. The alloy corresponds very closely with that commonly known as "Admiralty gun-metal," and the chemical composition and physical properties of the material are laid down. Another bronze specification, No. 384, is for Hard Drawn Phosphor Bronze Wire, primarily for armature binding. This specification covers two grades of wire. It provides for the chemical composition of the material and specifies margins of manufacture and physical tests, including a test for the adherence of the coating of tinned wire. The other specifications relate to Pure Aluminium, and deal with Tubes (No. 385), and Bars and Sections, excluding wire bars (No. 386). The chemical composition and physical properties of the finished material are specified, and clauses giving permissible margins of manufacture for the finished tubes, bars, and sections are included.

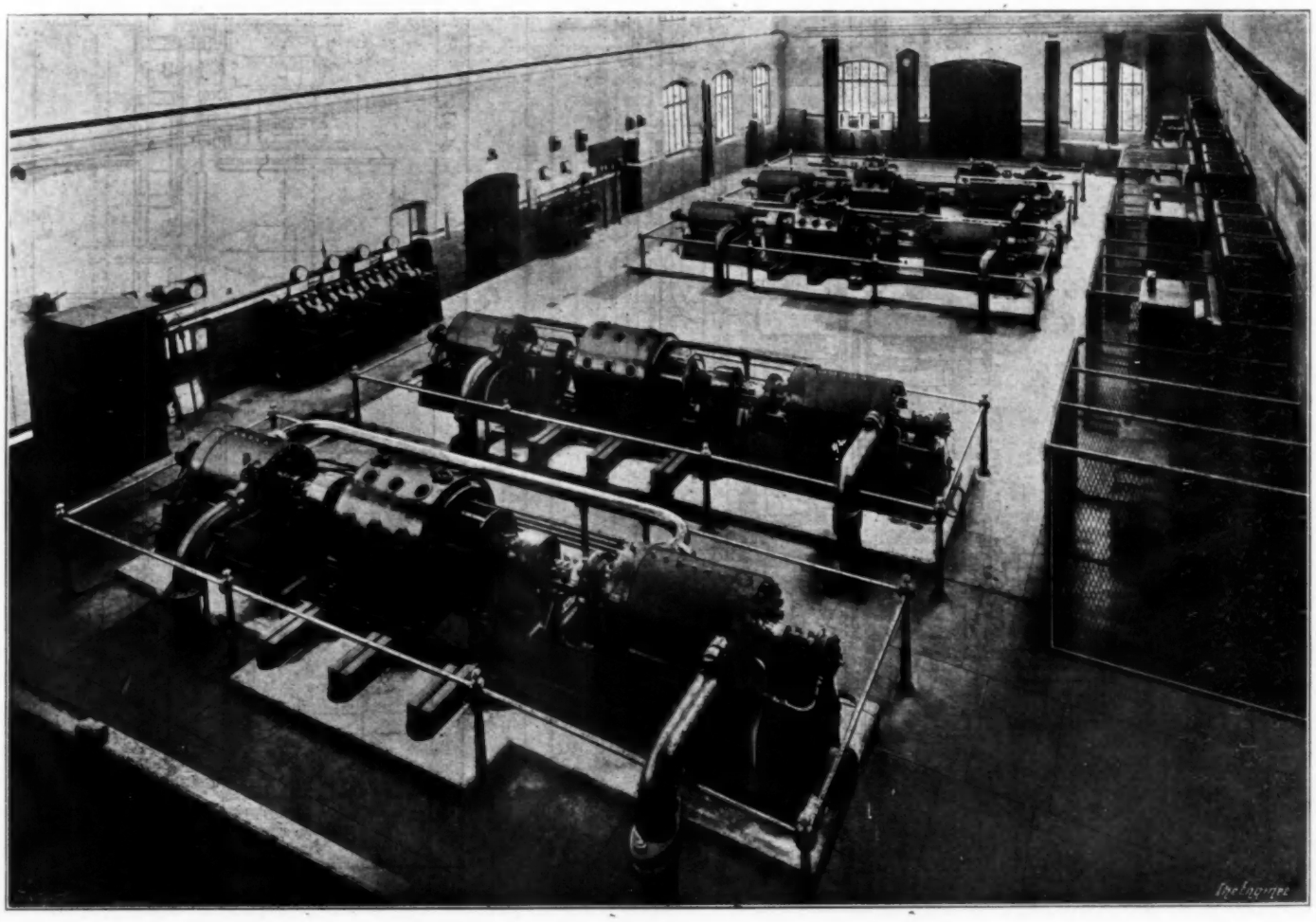
Copies of the above five specifications may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria-street, London, S.W. 1, price 2s. 2d. each post free.

ALFRED STREET HYDRAULIC PUMPING STATION, HULL

THE PULSOMETER ENGINEERING COMPANY, LTD., READING, ENGINEERS

(*For description see page* 91.)

GENERAL VIEW LOOKING TOWARDS THE MOTOR STARTERS

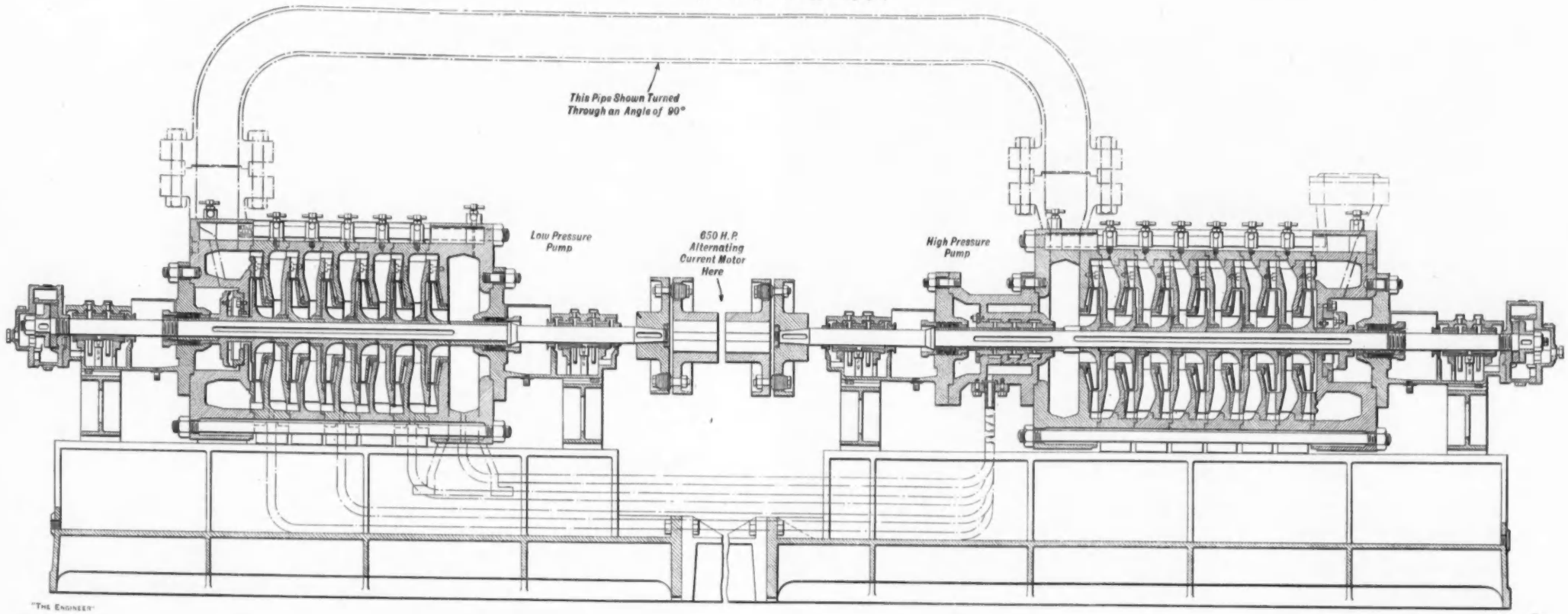


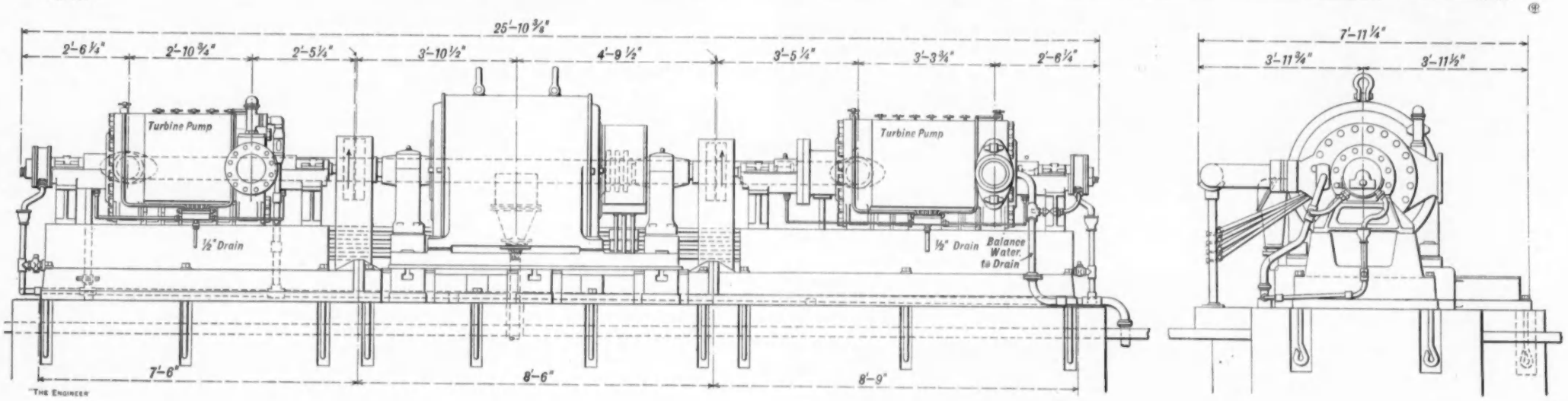
GENERAL VIEW WITH LARGER PUMPS IN THE FOREGROUND

ALFRED STREET HYDRAULIC PUMPING STATION OF THE L. AND N.E. RAILWAY, HULL

THE PULSOMETER ENGINEERING COMPANY, LTD., READING, ENGINEERS

(For description see opposite page.)


This Pipe Shown Turned Through an Angle of 90°
Low Pressure Pump
650 H.P. Alternating Current Motor Here
High Pressure Pump
"The Engineer"



SECTION AND GENERAL ARRANGEMENT OF CENTRIFUGAL HYDRAULIC PUMP

Alfred Street Hydraulic Pumping Station, Hull.

A VERY fine plant for supplying high-pressure water to the hydraulic machinery round the docks of the London and North-Eastern Railway at Hull has recently been put into commission. It is illustrated by the half-tone engravings on page 89 and by the line drawings below and opposite. This machinery, which is electrically driven, minute capacity, and the necessary equipment for their service and running. Looked at from another point of view, the size of the plant may be gauged from the fact that the electric motors installed have a total capacity of over 2600 horse-power. All this plant, which has been supplied by the Pulsometer Engineering Company, Ltd., of Reading, had to be erected in an existing building which accommodated the old steam pumps, and yet the supply of water had to be maintained. So the engines were dismantled in sequence and their places taken by the new sets as they were scrapped. The consequence is that the work of erection was very complicated and arduous, but, as will be seen from our two views on page 89, a very handsome power station has been evolved.

It is noteworthy that all the exhaust water from the hydraulic appliances round the Hull Docks is sent back to the pumping station and is used over again, so that the machinery works under the more favourable condition of handling clean water, as compared with those installations which we reproduce, as it indicates the principles on which the plant is safeguarded against accidents on the hydraulic side. It will be understood that this diagram shows only one main pump, but all four are equipped alike.

In the yard of the station there are two large underground tanks, of some 10,000 gallons capacity each, which are indicated by the tank marked "sump," in Fig. 2. All the water from the hydraulic machinery in the docks is drained back into these tanks. And here we must digress. It might be thought that the return water pipes could be of comparatively light scantlings, but, as a matter of fact, they must be quite substantial for the following reason. Work in the docks may be slack and the flow of return water sluggish. Suddenly several cranes or tipplers start work and discharge their exhaust into the return mains. The effort necessary to accelerate the column of water in the main may involve such a rise in pressure as to burst the pipes unless they are well made and jointed.

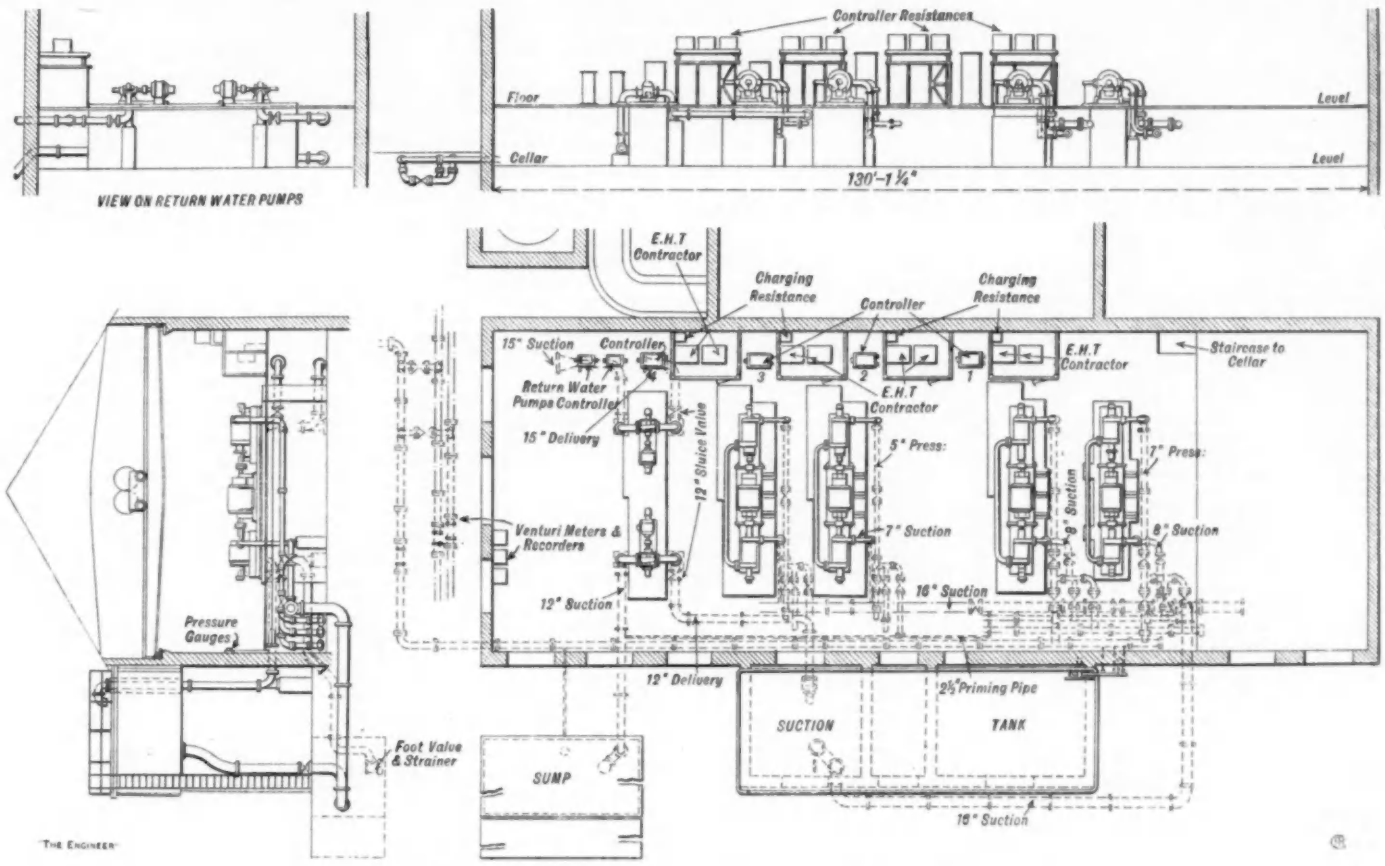


FIG. 1—GENERAL ARRANGEMENT OF 2600 H.P. HYDRAULIC PUMPING PLANT

has been put in to take the place of an old steam plant that had become obsolete, and although it is too soon to say what money economies may be effected by the change, it is known that while the old installation would pump 2300 gallons of water per minute against a pressure of 850 lb. per square inch per 1 cwt. of coal burned, the new sets will pump 85 gallons per minute for the consumption of 1 B.T.U. of electricity. Incidentally, we believe a

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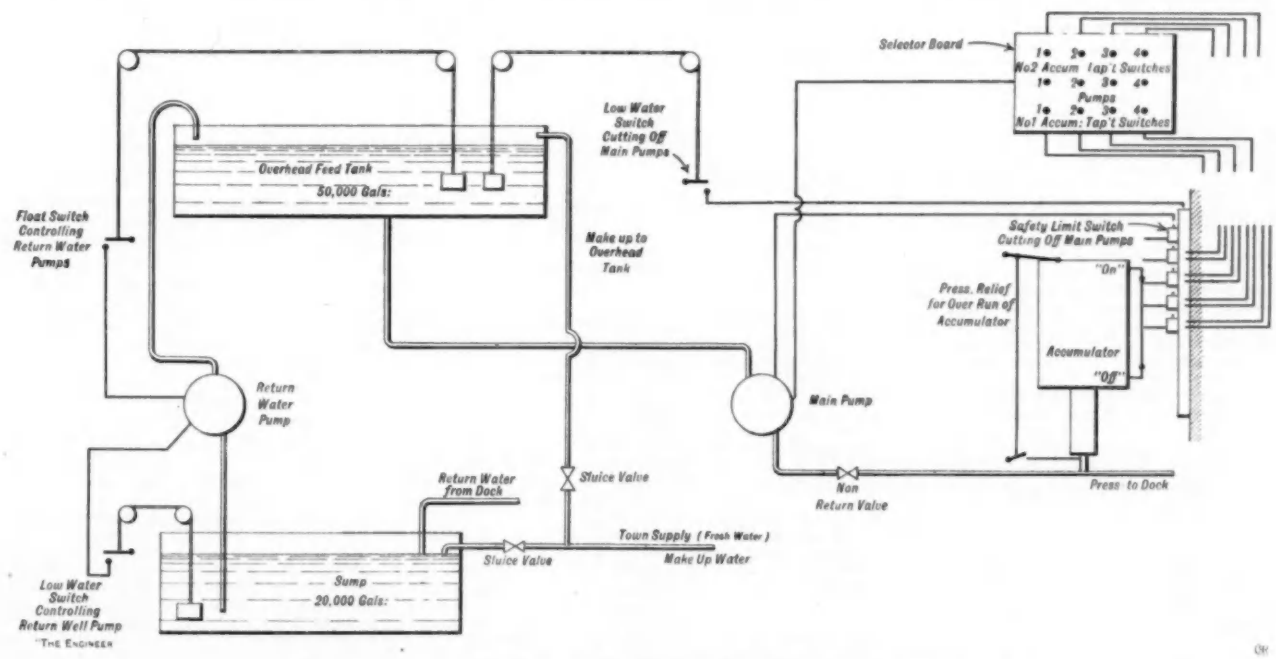

FIG. 2—DIAGRAM OF SAFEGUARDING ARRANGEMENTS IN PUMPING STATION

more trustworthy supply of water has been provided in the mains. Nevertheless, there is still at the station a syren, which may be blown in the event of a total shut down, to warn the drivers to take steps to prevent dropping their loads.

In broad outline the plant comprises two electrically driven multi-stage centrifugal pumps capable of delivering 800 gallons of water per minute against a pressure of 850 lb. per square inch, two similar pumps of 600 gallons per

in which the exhaust water is led to the drains, and the pumps have to draw dirty dock or river water. But, there is, of course, some inevitable loss of water through leaky glands and pipe joints in the dock machinery, which amounts to some 17 per cent. of that pumped. This loss is made up from the company's own fresh water mains, which convey fresh water from the company's pumping station at Hessle.

It may be as well here to refer to the diagram, Fig. 2,

Local pressures up to 125 lb. per square inch have been recorded in such circumstances.

Reverting to the sump, although it has a capacity for supplying the normal demand for about half-an-hour, without the help of any return water, it is provided with a 6in. connection with the L.N.E.R. Company's fresh water mains, which can be opened in cases of emergency.

In order to keep the main pumps always fully charged, so that they will start up immediately and not be delayed

by priming, they draw from an overhead feed tank of 50,000 gallons capacity. This tank is supplied by two 10in. Pulsometer centrifugal pumps driven by 55 H.P. Crompton-Parkinson motors. One of these pumps is sufficient for normal service and the other is kept in reserve. These pumps are controlled electrically in two ways. In the overhead feed tank there is a float which actuates a switch through a wire and starts and stops the pump to maintain a constant level. In the sump there is another float, with its switch, which stops the pump in the event of the water in the sump falling to a dangerous level. The make-up water is also supplied to the overhead feed tank from the L.N.E.R. fresh water service mains.

For the protection of the main pumps from shortage of water there is another float in the overhead feed tank, which operates a switch to trip the starters of the main pump motors if the water falls too low. There is a non-return valve in the pump delivery so that when it does stop pressure water from the general system cannot flow back through the pump into the tank.

There is yet one other automatic control of the main pumps in connection with the hydraulic accumulators. Alongside each of the accumulators—see Fig. 4—are guide rods on which are fixed five tappet switches, four of which are for starting and stopping the pumps. The fifth and uppermost is a safety switch, which in the event of the accumulator rising above its safety limit stops all of the main pumps.

These switches are operated by two tappets, one for tripping the switches "on" and one for "off," mounted on slides attached to the ram of the accumulator.

The object of mounting both tappets and switches on slides is obviously to enable them to be set in the most suitable positions.

As the ram of the accumulator rises the lower or knock "off" tappet trips an arm on the side of the switch and stops the pump. As it falls the uppermost or knock "on" tappet reverses the operation and re-starts the pump.

There is a space of 8ft. between the two tappets, so that the ram has to fall through that distance after stopping a pump before it again re-starts it, thus making the control less sensitive to slight fluctuations in demand and giving a margin which reduces the possibilities of a pump starting up merely to supply a momentary increase of load to be cut off again immediately. Again, the characteristic of the pumps, as indicated by the curves—see Fig. 3—is to

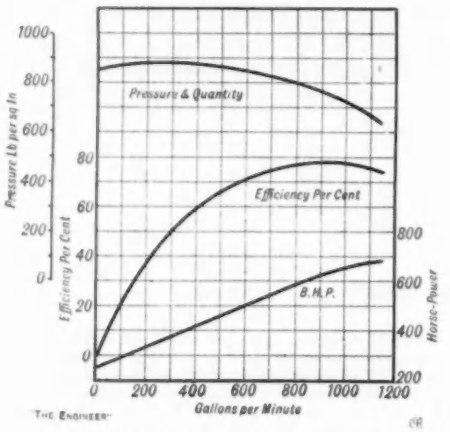

FIG. 3—CHARACTERISTIC CURVES

deliver more water as the pressure falls, which obviously is also a favourable quality in this connection, rendering it possible on normal load to keep the accumulator ram floating at about mid-stroke with one or two pumps running continually at full capacity, thus maintaining their highest efficiency and the third and fourth pump only coming in intermittently to deal with increases of demand from the dock machinery.

In order that each pump in its turn shall get its fair share of work, a selector board is provided, by means of which the tappet switches can be so interconnected that either switch can control any pump and in any sequence, also either accumulator can be used, they being equipped in duplicate.

The accumulators are housed in a separate building, and each has a ram 20in. in diameter by 23ft. stroke. In order to ensure that the rams may not be pushed right out, and the ballast, amounting to some 100 tons each, topped over into the basement, there are two precautions. First, there is a tappet arrangement connected by chain with a by-pass valve, which relieves the pressure, by returning the water to the sump, in the event of the accumulator rising too high, assuming that the safety limit switch has gone out of action. Finally, there is a massive wooden transom across the top of each accumulator, built into the walls of the building and secured to the basement, to prevent, forcibly, its further rise. We inquired how the pumps would fare should this last resource come into action, and were told that they would go on churning up the water they contained for quite an appreciable time without heating up dangerously.

Turning now to the pumps themselves, it will be seen from the drawings on page 90 that they are of the tandem two-unit type, with the motor arranged between the two units. The motor, it will be noticed, is not included in the section of the pumps, but is shown in the general elevation. It is mounted on transverse slides, so that it may be drawn away sideways for the removal of the rotors without disturbing the pumps. The motors are by Crompton Parkinson, Ltd., and are of 700 horse-power for the two larger units and of 550 horse-power for the smaller sets. They are of the protected slip-ring induction type, and take three-phase current at 6600 volts between the phases and a periodicity of 50 cycles per second. They have a synchronous speed of 1500 revolutions per minute, and run at 1475 revolutions per minute on full load. The power factor is 0·86. The load factor on the plant when pumping in this way generally amounts to some 40 per cent., and ranges down to about 25 per cent.

As will be seen from the drawing on page 90 the larger sets of pumps each comprise two pumps arranged in series on one alignment with the electric motor in between, and have thirteen cells and impellers in all. The smaller sets have eighteen cells, but are of lesser diameter. They are virtually a series of centrifugal pumps, with diffusing chambers in between, which convert the kinetic energy of the water, leaving the impellers, into pressure energy before it enters the eye of the next impeller. The casing of the pump consists of a number of sections or stages or cells held together by long bolts between the end covers, which form respectively the suction and delivery chambers. This construction eliminates any unseen leakage from cell to cell, and is very convenient when the pump has to be opened out for examination, as there is no difficulty in separating the cells. Alignment is secured by spigots and recesses in the component parts, and as each cell is provided with feet resting on the bed plates, there is no difficulty in making the spigots enter the recesses in reassembly. Lugs are provided on the cells for forcing them apart, rendering dismantling rapid and certain.

The diffusers are formed in the main casting, but the guide vanes and tips and the sides of the diffusers, which are in contact with high-velocity water, are made of a special bronze to resist the action of the water, and are easily renewable, being cast on the side of a ring which forms one wall of the diffuser passage. The stuffing-boxes are fitted with gun-metal bushes and have glands of gun-metal, which are bored sufficiently large to clear the shaft. The gland on the suction side is exposed to the pressure of the first cell only, while that on the delivery side is subject to the pressure in the balance chamber only. In the case of the second unit, however, the gland at the suction end would be subjected to considerable pressure unless precautions were taken to relieve it.

As will be seen from the drawing, there is, between the stuffing-box and the inlet chamber, a long sleeve, which has four annular passages. Three of these passages are connected by piping, as shown, with the diffusers of three intermediate stages of the low-pressure pump, and the fourth to the suction. The result is that water leaking back through the sleeve towards the gland is led back stage by stage to the low-pressure pump and the gland is finally subject to only the pressure existing in the suction side of the first cell.

The end thrust on the shaft of each pump caused by the difference of pressure on the opposite sides of the impellers

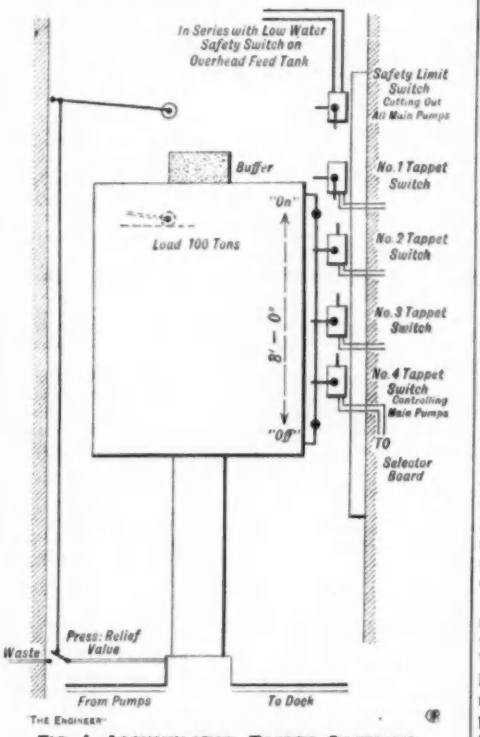

FIG. 4—ACCUMULATOR TAPPET SWITCHES

is taken up by a balancing disc at the delivery end of the pump. This disc is secured to the shaft, almost in contact with an annular seating and the intervening space is supplied with pressure water from the last impeller. This water spills away through the clearance between the disc and its seating, and maintains the balance of thrust on the shaft. The movement for this purpose is hardly perceptible, and the amount of water which has to be re-pumped amounts to only about 1 to 2 per cent. of the total output, while the arrangement, obviously, reduces friction to a minimum. A Michell thrust block is fitted as an additional safeguard.

The curves which we reproduce show the characteristics of these pumps, which include the valuable feature of being able to start up against full head without any relieving device or overloading the motor. The mechanical construction of the pump needs little comment, except to say that the high-pressure casings are of cast steel and that the main bearings are ring lubricated.

The two pumps for raising water from the sump to the overhead feed tank are of the Pulsometer Company's standard 10in. horizontally split type. They are automatically controlled by the float gear already described.

The supply of electric current for the whole of the pumping station is taken from the town's mains at a pressure of 6600 volts, and is supplied to the main pumps at that voltage. For the supply of the motor starting contactor gear and other minor services, current is reduced to a pressure of 400 volts by rotary converters in a sub-station built on to the pump house.

The main high-tension switches which control the feeders to the several pump motor starters are so interconnected with the low-tension circuit of the starters that there is no possibility of the starter being held in on short circuit in the event of the supply failing, and then being put in again with no resistance. This part of the equipment is of the Reyrolle ironclad type, while the starters themselves are by the Electric Control Company, Ltd., of Glasgow.

The piping system, on both the suction and delivery sides, needs little comment, although it required considerable ingenuity to install the new piping and connect it up with the existing mains without interfering with the supply of water to the docks. It includes three Kent Venturi meters with integrating and recording instruments in the pump house.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

LINKS IN THE HISTORY OF THE LOCOMOTIVE.

SIR,—Under the above title, on page 57, July 18th, 1930, there is a reference to a water-tube locomotive proposed for the Gloucester and Cheltenham Railway in 1825. As very little can be adduced in that article concerning the construction or the final outcome of its use, readers interested in the subject may learn something of the McCurdy boiler in question from a letter, dated London, March, 1827, published in the "Franklin Journal," from Jacob Perkins, M. Inst. C.E., which also refers to the Brown gas vacuum engine which Mr. Dendy Marshall had, at first, confused with the McCurdy-boiler.

This review of recent prime movers in 1827 by Perkins states that McCurdy, of New York, had brought out two of Hawkins' projects, and had declared that Perkins had stolen Hawkins' idea. Yet, later on, admitted that he was altogether ignorant of Perkins' method of generating supersteam—"high" steam—by small quantities of water under pressure, but "for the want of this pressure—which is the novelty I claim—more than a dozen projectors, who have attempted to make tubular boilers since I commenced my experiments, have all failed. Indeed, there are not, at this day, ten persons in the world who are wholly acquainted with it." This Perkins' system embodied most of the features which have recently been illustrated in the engineering and railway press as the "Loeffler system," but it was much more simple. To prevent ebullition of the water at critical pressures, Perkins confined it in the primary boiler under a loaded valve, so that it could not expand into steam, although heated to 500 deg. to 600 deg. Fah., and over, and until forced out of the primary heating tubes by the circulating pump, whose force lifted the "pressure valve" and drove the superheated water into a thick vertical receiving drum, shaped like a large modern oxygen cylinder, standing in the centre of a circular furnace, of the gas-producer—"cupola"—type, and there maintained at red heat, this cylinder being made to withstand any steam pressure up to "4000 lb. per square inch." The highly superheated supersteam was only permitted to lose a portion of its pressure in the cylinder, which was bled, at high pressure, for indirectly heating the feed water boiler, this feed then returning at high pressure, through the circulating pump, into the ever full water tubes. The heat cycle was similar to that adopted for the Loeffler boilers, and this type of engine was manufactured from 1823 to 1826 in Fleet-street, under the works series "No. 3." On the contrary, the McCurdy boiler was of a very ordinary type. Perkins adds that, in all, McCurdy had had made three boilers, all for steamboats, which took passengers to Richmond, on a service that has now—1827—been abandoned.

Of the Brown vacuum gas engine he mentions that this motor had then—1827—"been given up"—although we know of records of its use until some six years later. With praise for its beautiful construction, "which operated like a charm before visitors," he observes that "Brown made his own gas, or else drew it direct from the city pipes when the consumption was enormous." His explanation of its failure was that mercury has a vacuum of 20in., whereas the rarefied air in the cylinder became denser than the air towards the end of the piston slides, and he fears that Morey's explosion engine will be unavailable from the same cause. He thinks Brown had been used very ill by the Vacuum Engine Company, which had, however, lost much money on the venture, and to the suggestion that he—Perkins—should have had charge of the enterprise, Perkins had replied that the only advantage from that would have been a reduction in the loss of the money by the firm.

Branscombe, July 19th, 1930. C. R. K.

AN aluminium factory, built in the city of Leningrad, says the *British-Russian Gazette*, has recently been opened. During the test the electric plant of this factory worked without interruption and supplied energy for the electrolysis of aluminium oxide and the first aluminium entirely of domestic materials was produced in Soviet Russia. This experiment shows that, in spite of the difficulties, the Government assignment to build huge aluminium plants in Leningrad and on the Dnieper River will be carried out on time. The work at the Leningrad aluminium factory is done exclusively by Soviet workmen and technicians. It is planned to operate this factory for a year and a-half or two years until gigantic aluminium factories are built both in Leningrad and on the Dnieper River. During this period the present aluminium factory will be used as an experimental school for the study of aluminium manufacturing processes and for training workmen.

Railway and Road Matters.

WE are informed that the Museum of the Peaceful Arts, New York, has ordered, from Robert Stephenson and Co., Ltd., a full-size replica of the "Rocket," similar to that made for Mr. Henry Ford, save that it is to be in part section.

THERE was a collision in Grimsby Town Station, L.N.E.R., on Tuesday, July 15th, of sufficient seriousness to lead to seven passengers having to be detained in hospital. A passenger train from Sheffield to Cleethorpes was standing in the station and about to start, when it was run into in the rear by a similar train from Hull.

THE fourth annual report—for the year 1928–29—of the London and Home Counties Traffic Advisory Committee has been issed as a Stationery Office publication, price 2s. 6d. Whilst obviously mainly relating to London there are certain aspects of interest generally. In particular would we refer to the three pages devoted to the prevention of street accidents.

WHEN the London and North-Eastern Company introduces its winter and spring train services on September 22nd the Hexham and Allendale branch and the Alnwick and Cornhill branch will be closed against passenger traffic. There are fourteen stations on these branches. On the same date twelve stations on the York, Malton, Seamer and Scarborough line will cease to deal with passengers.

THE Glasgow Corporation is seeking additional powers in relation to the municipal transport undertaking—on which, by the way, there were, at one time, halfpenny fares. In giving evidence before the Select Committee of the House of Lords, the Chairman of the Transport Committee of the Corporation said that whereas the tramways formerly served the inhabitants, there were now 220 municipal omnibuses and 1300 private omnibuses as well. He did not know any city in the United Kingdom where traffic was so congested.

WE have, from time to time, had occasion to quote from the *Railway Review*—the organ of the National Union of Railwaymen. It gives us pleasure, then, to congratulate our contemporary on its jubilee—on July 16th. Its main work was done in the days of the Union's principal predecessor, the Amalgamated Society of Railway Servants. Just as that body had a long, stern, and often discouraging fight to secure the rights of trades unionism in the railway service, so has the *Railway Review* had to fight its way into the high position it now holds as the mouthpiece for the men.

THE Ministry of Transport railway statistics for April have been issued as a Stationery Office publication, price 3s. 6d. It must be remembered that whilst both Good Friday and Easter Monday fell in April this year, the Good Friday of 1929 fell in March. The number of passenger journeys in 1930 were 0·2 per cent. more than in 1929, and there was an increase of 11·4 per cent. in the receipts from passengers; these were earned by an increase of only 0·7 per cent. in the passenger train mileage. The tonnage of freight traffic, on the other hand, fell by 6·5 per cent., and the receipts therefrom by 8·5 per cent. That mainly was brought about by a drop of 3·1 per cent. in the coal traffic. A reduction of 5·4 per cent. was effected in the freight train mileage and, because of the less coal traffic, train movements were quicker and the net ton-miles per engine-hour rose from 446¾ to 459¼.

THE first motor train ever operated between the Atlantic and Pacific oceans has been put into commission by the International Railways of Central America. The train was built by the J. G. Brill Company, after a careful study of the requirements of the International system, which embraces, among other engineering difficulties, a 17-mile continuous 2·4 per cent. gradient reaching an altitude of 3000ft. It is expected that it will operate as a boat train between Puerto Barrios and San Salvador on the new route inaugurated early this year. The train consists of a motor car weighing 39,295 lb., carrying a paying load of 6900 lb. in the passenger compartment and 3000 lb. in the baggage compartment. The passenger compartment will be for second-class passengers and will seat thirty-seven persons. A trailer with an observation platform and equipped with leather upholstered seats will accommodate twenty-two first-class passengers. The trailer weighs 27,460 lb. The power unit is a six-cylinder, four-cycle, heavy-oil engine, rated at 175 H.P. at 1300 r.p.m., situated at the forward end, driving through a four-speed gear.

THE collision of February 17th at Rutherglen on the main line of the Northern Division of the London, Midland and Scottish Railway, mentioned herein on February 21st, was inquired into by Lieut.-Colonel Mount, whose report thereon was issued recently. The main factor in the situation was a dense fog. The trains concerned were one for Coalburn, which arrived at the home signals for Rutherglen at about 6.21 p.m., and one for Strathaven, which ran into the rear of the Coalburn train. With one exception all the men concerned did their work correctly and, further, all the provision necessary was made for working in the fog. The exception was the signalman in Rutherglen box, who irregularly sent the train-out-of-section block signal for the Coalburn train, although it was still outside his home signals, and accepted the Strathaven. We have just remarked that all the provision necessary for working in fog was made. One such provision was to furnish the signalman with what is colloquially called a "tail-lamp man," *i.e.*, a platelayer who assists the signalman by watching the passage of trains. The signalman preferred, however, to rely on his own observation and, as Colonel Mount remarks, "in effect, McElwee's services were being wasted." Had the signalman made greater use of the platelayer, that man, when the signal was restored for the Coalburn train in error, would have reminded the signalman that the train had not passed. Colonel Mount makes only two recommendations. One relates to the question of assistance for the signalman. It is advised that consideration be given to the desirability of laying down some instructions as to the duties of assistants. The other recommendation relates to the replacement of two-position block instruments by the standard three-position now adopted and the formulation of an appropriate programme of replacement.

Notes and Memoranda.

IT is estimated that the introduction of wire saws into the slate quarrying industry of the United States has effected a saving of a quarter of a million dollars a year.

THE average weekly output of beryl crystals from the Somerset mine, in the Leydsdorp district of South Africa is from 12 lb. to 15 lb. To secure this result from 120 to 150 tons of schist are drawn from the mine each shift.

A STEAM turbine power plant of 43,750 kW has just been put up on the Rio Grande at El Paso, Texas. It has two Stirling boilers, each of 15,253 square feet, which are fired with natural gas. The whole plant was erected in eight months.

A SET of working drawings for the governing mechanism of a large centrifugal fan were recently sent by the Sturtevant Company of Boston, Massachusetts, to London by means of Transatlantic radio, and was found to be quite satisfactory for manufacturing purposes.

IN a paper on the dry quenching of coke, contributed to the American Society of Mechanical Engineers, Mr. W. O. Renkin said that the capital cost of a dry quenching installation could be recovered by the economies effected, as compared with water quenching, in less than fifteen months.

IT is claimed that the new Marshall Field building in Chicago is the largest building in the world. It is eighteen stories high and has a total floor area of 4,000,000 square feet. Heating is provided for by five 5050 square feet and two 2500 square feet boilers, supplying steam at 100 lb. per square inch. Electric current is taken from the public mains to the extent of 7000 horse-power for power purposes and 8000 kW for lighting.

A CLAMSHELL bucket or grab has been produced by the Erie Steel Construction Company of America, in which the opening and closing is effected by an electric motor mounted directly on the grab. Advantages claimed for the new bucket are that it can be attached or detached in a short time, works within its own height, digs in so that a full load is always obtained, requires no friction clutches, chain or trip rope, and empties all or any part of the load as desired.

INVESTIGATIONS by the Carbide and Carbon Chemical Corporation, New York, have shown that their new product triethanolamine is very serviceable for the absorption of acid gases. Experimental work has shown that triethanolamine solution will rapidly and completely remove hydrogen sulphide, carbon dioxide, sulphur dioxide, chlorine, hydrochloric acid, and many other acid gases, not only from air, but also from manufactured refinery or natural gases. The absorbed gas is readily recovered from the liquid by heat, making the solution ready for another cycle of absorption and activation.

THE severest tests to which a welded vessel has ever been subjected, reaching pressures of 10,000 lb. per square inch, were, says *Power*, recently completed at the plant of the A. O. Smith Corporation in Milwaukee. The vessel tested is a reaction chamber built of chrome vanadium steel by welding for 5000 lb. per square inch working pressure in a chemical process. Walls are 3½in. thick. The vessel is 33ft. long with 26in. inside diameter. Following routine repeated stress tests and hammer tests at 8000 lb., the pressure in the vessel was raised to 10,000 lb. per square inch, and the entire vessel was carefully examined. Careful measurement and liquid volume readings showed that the vessel took no set or permanent distortion from the extremely high test pressures.

THE Sub-committee (Assessment of Compensation Water, Ministry of Health, 1930) proposes to retain the existing method of estimating rainfall over three dry years by deducting 20 per cent. from the long-period average, but to alter the basis of allowance for evaporation and absorption. It is proposed that this loss should be measured for every river by the difference between the rainfall and the run off, as ascertained by stream gaugings, which should measure all flows of the stream for a period of seven years. This period should be prior to or during the construction of impounding works. From this a method is suggested for arriving at the assessable flow on which the amount of compensation water should be determined in relation to the use of the stream by riparian interests.

IN connection with its study of the best methods for the utilisation of natural gas under circumstances such that it cannot be used directly for fuel, the United States Bureau of Mines, at its Pittsburg Experiment Station, has investigated its use in the production of formaldehyde. This compound has extensive use in the manufacture of synthetic resins, such as bakelite, from which is fabricated a multitude of useful products. Early work showed that traces of formaldehyde are formed when mixtures of methane—the principal constituent of "dry" natural gas—and air are suitably heated. Later work showed that certain gaseous catalysts, such as the oxides of nitrogen, enormously increased the yield of formaldehyde. The present work has shown, however, that until further developments are made, this method is impracticable, because of the excessive cost of the nitrogen oxides required to produce a given quantity of formaldehyde.

THE Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa., has announced the production of Phos-Copper welding alloys, which are marketed in rod and strip form. The material is composed essentially of copper and from 5 to 10 per cent. phosphorus, the rod form containing slightly more phosphorus than does the strip. The fluidity of the material is directly proportional to the phosphorus content. Phos-Copper begins to melt at approximately 700 deg. Cent. (1292 deg. Fah.), and becomes extremely fluid at 750 deg. Cent. (1382 deg. Fah.) for the rod and 800 deg. Cent. (1472 deg. Fah.) for the strip form. The presence of the phosphorus prevents the oxidation of both the copper and the surfaces being joined, thereby acting as a flux and producing a sound and dependable joint. At the same time, the phosphorus lowers the melting point and gives the alloy the characteristic of flowing freely when fused. The tensile strength of the deposit or joint varies from 18,000 lb. to 30,000 lb. per square inch and is greater than that of copper, but the ductility is less.

Miscellanea.

THE new waterworks at Chelmsford was formally opened on July 16th.

AN alluvial diamond weighing 133½ carats was recently found in the Orange River diggings, South Africa.

IT is expected that the output of mercury from Ras-el-Mia, Algeria, next year will be at the rate of 200 tons per annum.

IT is hoped to have the first section of the new automatic telephone system at Johannesburg in operation in about twelve months' time.

SOME extensive irrigation schemes, on which at least £250,000 will be spent in the initial stages, are being put forward in the Transvaal.

DURING the quarter which ended with June, the British air mail service carried 29 tons of mail. The corresponding amount for last year was 21½ tons.

IT is proposed to supply Regina, Saskatchewan, with natural gas from the Turner Valley of Alberta, which is 450 miles distant. It is estimated that the scheme will cost from 10,000,000 dollars to 15,000,000 dollars.

A THIRD and enlarged edition of the "Notes on Screw Gauges," by the Gauge Testing Staff of the Metrology Department of the National Physical Laboratory, has just been issued by H.M. Stationery Office, price 4s. net.

THE twin-screw whaling factory steamer "Tafelberg," built for the Kerguelen Sealing and Whaling Company, Ltd., Cape Town, by Sir W. G. Armstrong, Whitworth and Co., Ltd., left the Tyne on the 14th inst. on her trials.

WITH the object of facilitating the export of manganese ore from Beestbrock, the railway to Kimberley is being strengthened and a new high level bridge is being built across the river Vaal. Trains of 1000 tons will be used for the traffic.

PRODUCTION of oil in the Alberta fields during the month of April totalled 92,404 barrels, as compared to 74,844 barrels in the corresponding period last year. These figures were compiled in the Department of the Interior from the reports of operators.

THE Witbank power-house of the Victoria Falls and Transvaal Power Company now contains, in commission, five Parsons two-cylinder generating sets, each of 20,000 kW and sixteen Babcock boilers, each capable of evaporating 80,000 lb. of water per hour.

THE Association of Special Libraries and Information Bureaux will hold its seventh Conference at New College, Oxford, during the week-end September 19th to 22nd, 1930. The Conference will begin on the Friday evening, September 19th, and will end immediately after breakfast on the Monday morning, September 22nd.

THE Jeppe-street power station at Johannesburg is being extended by the addition of two new 10,000 kW Fraser and Chalmers turbo-alternators and four 60,000 lb. Babcock and Wilcox boilers. There is also to be a new Premier cooling tower. When these additions have been completed the station will be able to generate the major part of the power required in Johannesburg.

A LOCAL advisory committee of the Institution of Electrical Engineers for the Transvaal has now been constituted as follows:—Mr. W. Elsdon Dew (local honorary secretary), chairman; Messrs. J. Burnard Bullock, S. E. T. Ewing, V. Pickles, Bernard Price and Professor O. R. Randall. It is hoped that co-operation with the South African Institute of Electrical Engineers will be possible, particularly in discussing papers read before the Institution. There are over one hundred corporate members of the Institution in the area of the local secretariat.

THE Shatura power plant in the Central Industrial Region of the U.S.S.R. supplied, according to the *British Russian Gazette*, 59,536,722 kilowatt-hours of electricity during April, or 38 per cent. more than the figure set in the plan. The average amount of peat—30 per cent. moisture—used per kilowatt-hour was 1·29 kilos., as against the 1·37 kilos. of the plan. The cost of electric power was lowered 13·2 per cent., as against 8·4 per cent. fixed by the programme and the coefficient of useful work of the station was 20·1 per cent., as against the 19·2 planned.

THE official returns rendered to the Electricity Commissioners show that 709 million units of electricity were generated by authorised undertakers in Great Britain during the month of June, 1930, as compared with 694 million units in the corresponding month of 1929, or an increase of about 2·2 per cent. During the six months of 1930, up to the end of June, the total amount of electricity generated by authorised undertakers was 5381 million units, as compared with 5098 million units for the corresponding period of 1929, representing an increase of 5·5 per cent.

A MESSAGE from Moscow reports that during the first eight months of the current business year—October, 1929, to May, 1930—the Russian crude oil output reached a total of 10,700,000 tons, being 99·6 per cent. of the estimate and 62·3 per cent. of the year's programme. The production of the Naphtha Trust of the Baku district, Azneft, was 2·9 per cent. below the estimate. The borings represented 95·6 per cent. of the estimate, but prospecting work remained about 15·2 per cent. behind. Petrol production reached 979,800 tons—96·3 per cent. of the estimate—during the period and the paraffin output was 2,067,200 tons—98·8 per cent.

IT is proposed to start rolling hollow drill steel at Pretoria. At the beginning imported billets will be used. Later on, however, it is aimed to produce a small quantity of hematite pig from some very excellent iron ore deposits which have been secured, and this, with mild steel purchased from the Steel Corporation, will be worked up in electric furnaces into high-grade steel of the types required for drill steel, springs, tool steels, tires and axles. When the company is thus able to work up its own steels from South African materials, it is expected that a saving of from £15 to £20 a ton will be effected, as compared with the cost of importing special billets.

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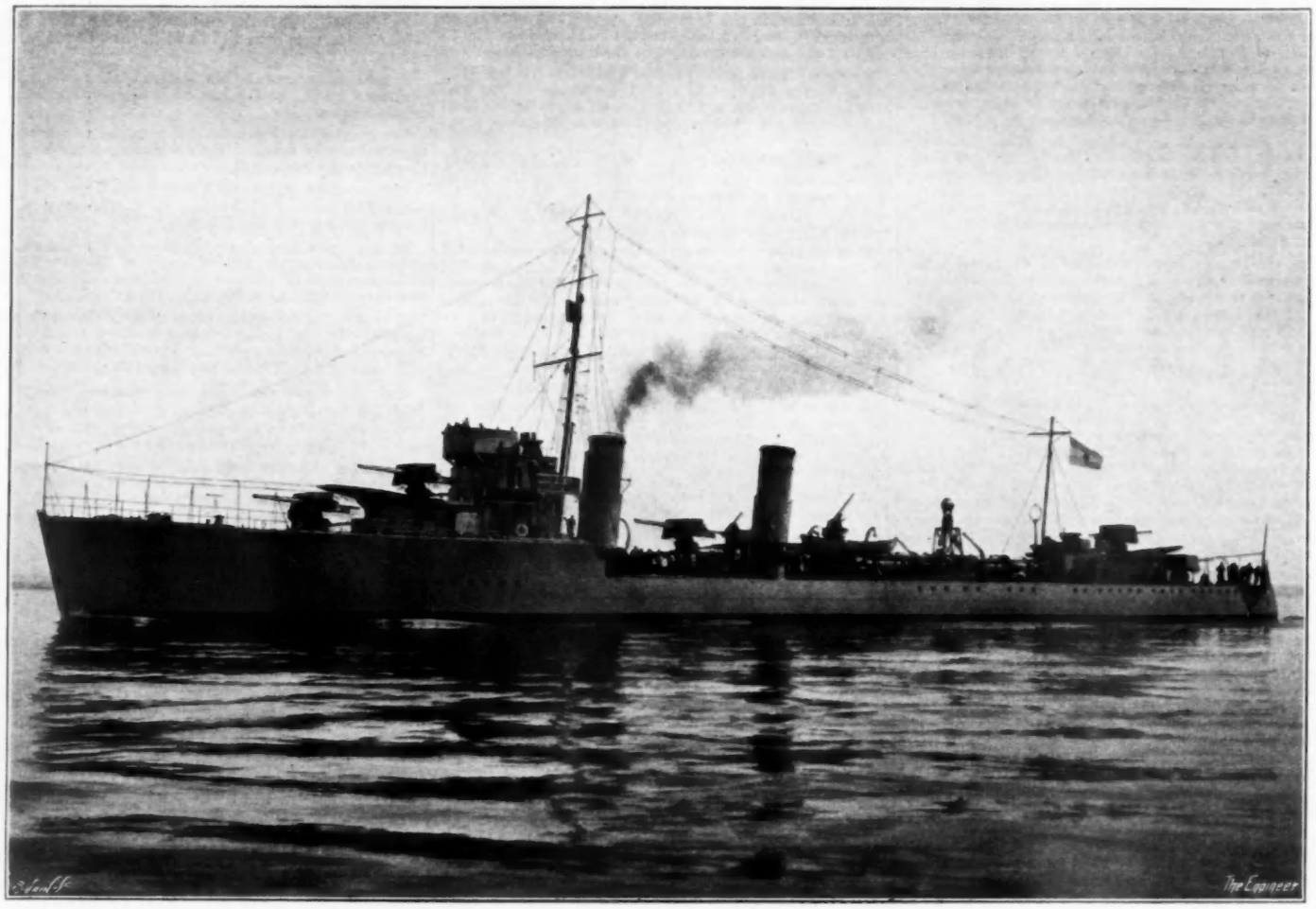

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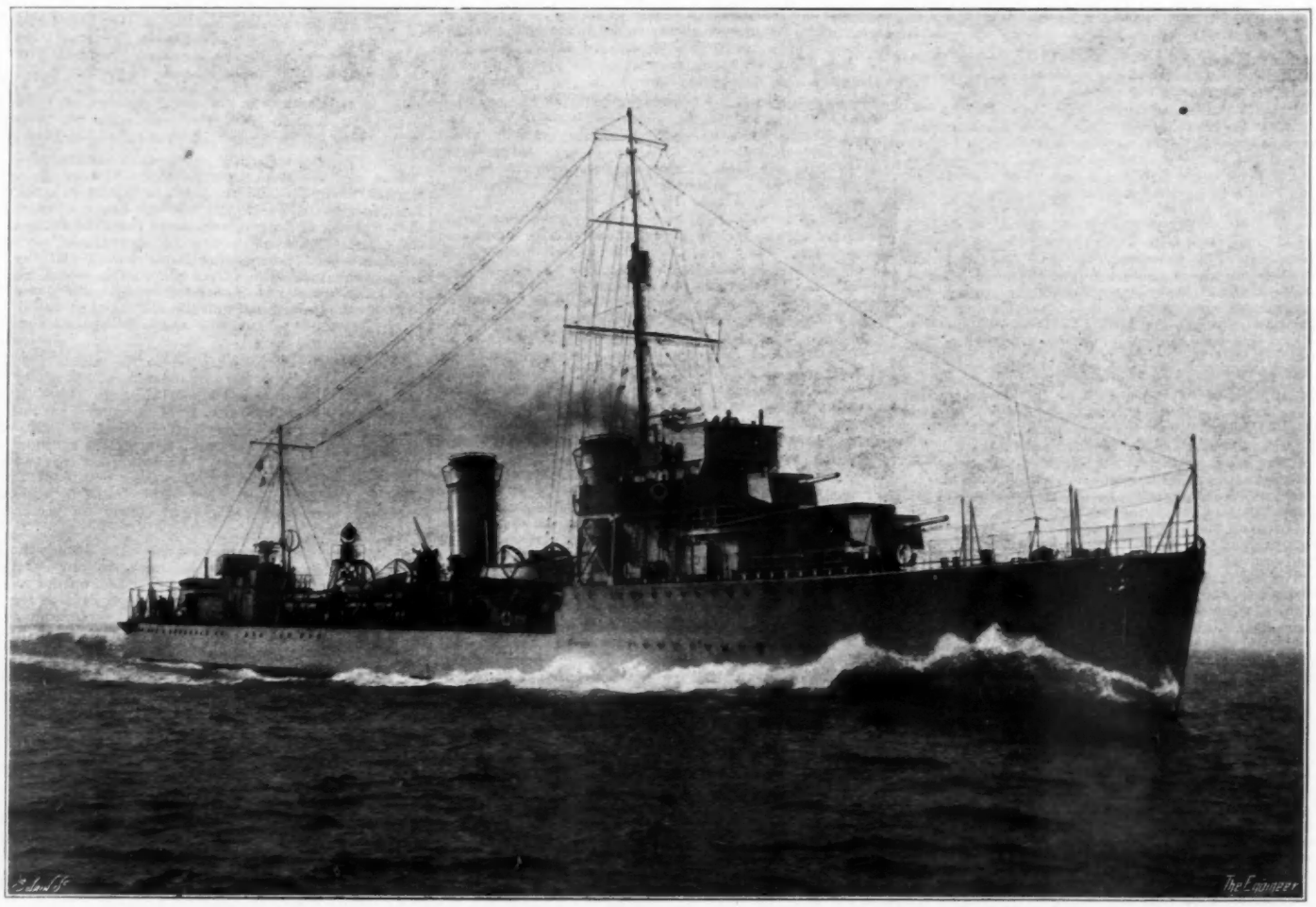

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THE ENGINEER.

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JULY 25, 1930.

Foreign Tongues.

THE Committee on Education for Salesmanship, under the chairmanship of Sir Francis Goodenough, has issued a second interim report. The subject is "Modern Langauges," and the object is to encourage the study of foreign tongues in Great Britain. The Committee has examined the methods of teaching foreign languages employed in several European countries, and contrasts them with the indifference to the matter which prevails here. In an Appendix it gives accounts of these methods. Whilst we may hope that manufacturing and trading houses will give attention to the views expressed by the Committee on the commercial value of foreign languages, we have no doubt that the directors and heads of colleges and universities will study the Appendix to which we have referred with care and interest.

English-speaking people all over the world regard their language as universal. They say that wherever they go they find it spoken, and that correspondence is addressed to them in it. They believe that in the not very remote future it will be so widely expanded in business circles that no other language will be necessary, and they refuse, on that ground, to take much interest in the acquisition of other tongues. This statement is far from the complete truth, yet in certain circumscribed conditions many arguments in support of it can be advanced. It can scarcely be denied that English is more widely used for international business correspondence than any other language, or that much would be gained if it did entirely replace others for that purpose. It will, we think, be agreed that, where correspondence is concerned, misunderstanding is less likely to arise when a single language is employed. If A writes to B in B's own language, and B replies in A's, there is more probability that some shade of meaning will be lost than when both use a third language C, or at any rate when both agree to use but one language, be it that of either A or B. Indeed, it seems rather ridiculous that A, let us say, should put himself to the trouble of learning B's language, when B is going to use his tongue. In such a case it is obviously unnecessary for both to have a foreign language, and since foreigners are much more prone to use English than we are to use their language, it would seem to be wise and economical to adopt English for general commercial correspondence. That is the form that the argument usually takes and, as we have said, there is much in its favour. But where salesmanship is concerned, it overlooks a very important consideration, upon which, we are glad to observe, Sir Francis Goodenough's Committee lays stress. Business cannot nowadays be done by post alone ; personal representation is essential, and the best representative is he who, given other qualities as well, is intimate with the mental attitude of his clients. Now it is beyond question that such knowledge can never be acquired in the absence of familiarity with the *spoken* tongue. "The conception of a language as the means of expression of a living people, influenced and conditioned by their surroundings, leads naturally to a study of those surroundings," says the Committee. "Foreign language instruction is therefore often related to instruction in the politics, society, and physical characteristics of the country in question—*a point to which employers cannot give too much consideration.*" The italics are ours. That is, we believe, an aspect of the teaching of foreign languages to which too little attention has been paid in this country, but, as we learn from the Report, it is one to which much importance is attached in continental universities, which, in many cases, stress the development of conversational powers and conjoin with it a study of the mentality of the nation whose language is being learnt. We may regard it as not improbable that the ability of the representatives of some of our competitors to amalgamate with the foreigners amongst whom they work is the outcome of a course of education designed to encourage familiarity with the mentality of other nations. Have not all of us been struck at times by the sympathy with which some foreign representatives who have learnt English enter into our feelings. Whether as hosts or guests, that kind of sympathy, even though it be fictitious and self-centred, is invaluable in the way of business.

About the more practical observations in the Report—the stress it lays upon the value of Spanish, for example—we need not speak, for we trust that manufacturers and merchants, no less than educationists, will study it carefully themselves ; but we must touch upon one aspect purely from the point of view of the technical engineer. Of the value of at least one foreign language to him there can be no doubt, but there is great difficulty in finding the necessary time for the study of it. In some cases young men go to a foreign university for part of their education and finish off their training in foreign workshops. Both plans are good, but the latter is likely to interfere least with the whole course of education. Furthemore, it is not unusual to find young foreigners in British engineering works. Hence we have all ready the elements of a scheme which might be developed with advantage. All that is needed is a reciprocal agreement between a number of Continental and a number of British engineering firms that each will take for a given period, say, six months or a year, a specified number of young engineers of foreign nationality, and will give them facilities for the completion of their training and for the acquisition of a new language at the same time. What is now done casually might become a recognised practice. Little more would be required for the achievement of that very desirable end than a small amount of organisation which the appropriate technical institutions would, we feel sure, be willing to undertake.

The Fixation of Carbon Dioxide.

ALMOST from the very beginning of the steam era prophecy has been rife concerning the period which would elapse before an end would be put to that era by the exhaustion of our coal supplies. As time has passed, the estimates of the prophets have steadily increased. In the middle of last century there were those who, basing their calculations on apparently sound data, assigned to our coal resources, at the then prevailing rate of exhaustion, a life which to-day should be nearing its end. The prophets of our own time are much more hopeful. Even allowing for the vastly

greater rate at which the coal measures are now being worked, they are prepared to give them a further life of three or four hundred years. Undoubtedly, the coal age—and with coal we may include oil—must terminate some day, but whether we are near its end, half-way through it, or just at the beginning, is a question which the cautious scientist may be advised to avoid. He should turn his thoughts, not so much towards the duration of our remaining coal supplies, as towards the discovery of a substitute or alternative for coal. The engineer and the chemist has each his own aspect of the question to consider. The engineer has to think of coal as a source of power; the chemist as a source of by-products and derivitives. The two aspects are not necessarily in harmony. So far as the use of coal for the production of power is concerned, the engineer is already prepared to provide at least one substitute. The generation of power from the tides is quite practicable. It is not practised to-day on a large scale because, relatively to the generation of power from coal, it has so far been found commercially unprofitable. With the approach of exhaustion of our coal resources, however, tidal power would, if nothing better turned up in the meantime, present a perfectly practical way out of our difficulties from the engineer's point of view. It would not, however, solve the chemist's problem. Power alone cannot be converted into tar, dyes, high explosives, flavouring substances, disinfectants, scents, and medicines. The chemist has, therefore, to find a material substitute for coal as distinct from the engineer's energy substitute.

The chemist's aspect of the subject was presented last week by Dr. Herbert Levinstein, in a manner which has attracted much attention. Addressing the members of the Society of Chemical Industry at Birmingham, he discussed the problem of operating directly on the carbon dioxide of the air in such a way as to obtain by synthesis the materials now derived from coal. He offered an outline of a possible technique. Carbonic acid, he said, could even now be completely reduced to methane. That gas, in turn, could be almost completely converted in an arc oven into acetylene, and acetylene could be polymerised into a tar, about half of which was benzene. In that way, he argued, we could tap the inexhaustible supplies of carbon dioxide in the atmosphere and obtain the same final result as Nature gave us by way of coal after a geological age. He pointed to the success with which the cognate process known as the fixation of atmospheric nitrogen is now being practised, and suggested that similar success ought to be within our command as regarded atmospheric carbon dioxide. There is, we may take it, nothing fantastic or unscientific in Dr. Levinstein's suggestion. The method indicated is undoubtedly a rational means of achieving the desired end. That end is, however, a chemical one, namely, to obtain a substitute from which to produce the materials at present derived from coal, or, more exactly, from coal tar. Dr. Levinstein's process is not a solution for the engineer's aspect of the problem. Indeed, it appears certain that in a coal-less age, its practicability would turn upon an entirely independent solution of the engineer's problem having been reached beforehand. It is obvious that if the chemists can give us either methane, acetylene, or benzene, we, as engineers, can give the world, including the chemists, power. It is less obvious, but none the less true, that the chemist cannot give us even the first of these substances without calling upon us to supply him with more energy than we can derive from it by using it as a fuel. The synthesis of methane from carbon dioxide and hydrogen, followed by the combustion of methane to carbon dioxide and water, cannot possibly be self-supporting from the energy point of view. It falls short of being self-supporting by the amount of energy required to disrupt water into hydrogen and oxygen. Moreover, even though the cycle were just self-supporting as regards energy, it would not serve Dr. Levinstein's purpose to give all the methane produced to the engineer for fuel. He requires some portion of it himself to convert into acetylene and finally into benzene. These later stages, it may be noted, make further demands for energy, and are still less self-supporting than the first. The amount of external power which would be required to convert atmospheric carbon dioxide into the final product, benzene, cannot be estimated satisfactorily, but that it would be considerably more than the quantity which could be produced by consuming the whole of the benzene output as fuel is certain. Hence, Dr. Levinstein's suggested process, intensely interesting as it is from the chemical point of view, is no solution of the engineer's problem. On the contrary, it demands the engineer's active and successful co-operation. Some idea of the extent to which that co-operation would be required may perhaps be obtained from the fact that at Billingham, where the analogous process of nitrogen fixation is conducted, the power station equipment has a capacity of 93,000 kilowatts. If the hypothetical benzene factory required the same amount of power, and if it relied entirely on its own product for fuel, it would have to produce annually 60,000 tons of benzene before it could utilise a single ounce otherwise than as fuel.

What we have said about the specific process outlined by Dr. Levenstein must, so far as we know at present, apply equally to any other method of obtaining a synthetic material capable of replacing coal from the chemical point of view. Such materials can be, or might conceivably be, made available, but in their production they would require the expenditure of more energy than they themselves are capable of yielding on combustion. It is certain that not even Nature herself works in this respect with an efficiency of one hundred per cent. The amount of solar energy expended on the production of a pound of coal must be greater—probably vastly greater—than the energy which we can recover from it by its combustion. Equally, it would appear that the engineer need look for no help from the physicist. Within the atom there is, or is thought to be, a store of energy which we used to be told was enormous, but concerning the amount of which there now appears to be some doubt. So far no means of tapping it have been discovered, but all the facts seem to indicate that at least as much energy would be required to effect the release as would be set free from within the atom. Where, then, it may be asked, is the engineer to look for a solution to his aspect of the problem of finding a substitute for coal, an aspect which is clearly fundamental in a way which the chemist's and the physicist's are not. The general answer to that question is clear. He must seek to utilise the current energy of the sun. Under that heading we may place sun power plants, hydraulic plants, tidal power plants, and fuel plants consuming recent vegetable growths and their products. In one of these directions, or it may be in some cognate direction yet to be discovered, which, like them, relies on the contemporaneous activity of the sun, lies the engineer's opportunity for solving the problem of finding a source of power capable of replacing our present coal supplies.

Profit-Sharing in 1929.

DISTINCTLY better results are shown by the report for 1929 on profit-sharing and co-partnership in the engineering and allied trades, issued by the Ministry of Labour. In businesses other than co-operative societies 47 schemes were known to be in operation at the end of the year, out of a total of 88 which had been started. These 47 schemes were promoted by 44 firms, which employed approximately 82,800 workpeople, of whom 23,700 were entitled to participate. Detailed particulars are given of 31 schemes in this group of industries, in which there were 18,600 participants, to whom an average bonus was paid for the year of £3 12s. 3d., giving a 3 per cent. addition to earnings. These figures compare with 32 schemes, 19,800 participating workpeople, and an average bonus of £2 11s. 7d., or 1·9 per cent. addition to earnings during 1928. In all industries, 330 schemes, with 229,200 participants, out of 499,000 employed, were still in operation at the end of last year. Detailed returns show 253 schemes, 188,700 employees entitled to participate, and an average bonus of £10 2s. 11d., giving an addition to earnings of 4·8 per cent. During the year eight schemes were terminated for various reasons, that given for one connected with a tin mining concern being diminution of profits. Three gas companies also discontinued their schemes on amalgamation with a similar company practising co-partnership. Among the fifteen new schemes is one connected with the manufacture of special steels, employing 1200 workpeople, the scheme providing for the issue to employees at par of 7½ per cent. cumulative participating preference shares, carrying rights to supplementary dividends. Seven other new schemes were connected with the supply of electricity and one with the manufacture and distribution of gas. All the electricity schemes are based on the sliding-scale arrangement embodied in the London Electricity Acts, 1925. The gas scheme follows the customary plan of a bonus increasing with each fall in the price of gas below a given figure, one-third of the bonus being withdrawable, the remainder being invested in the company's stock. A table giving comparative figures for the last twenty years, shows that while the number of schemes in operation has increased from 123 in 1910 to 330 in 1929 and the number of participating employees from 57,000 to 229,000 during the same period, the percentage addition to earnings given by the bonuses has varied only slightly. In 1910, with 76 schemes making returns, it was 5 per cent., and in 1929, 253 schemes gave 4·8 per cent., the highest figure during the two decades being 6·7 per cent. in 1914 and the lowest 3·6 per cent. in 1921. In the section of the report relating to co-operative societies, 165 schemes with 30,500 participants, are stated to have been in operation among all classes of societies at the end of the year. Brief details are given of 157 schemes, with 30,400 employees entitled to participate. The average bonus distributed amounted to £5 10s. 9d., giving an addition to earnings of 4·4 per cent. Taking into account all businesses and including co-operative societies, the Ministry reports that 495 schemes were in operation at the end of 1929. It gives, also, the financial results of 410 schemes, under which an average of £9 10s. 2d., or 4·8 per cent., on earnings was distributed.

Literature.

Blast-furnace Practice. By FRED CLEMENTS. In three volumes. Vol. III.: *Operation and Products.* London: Ernest Benn, Ltd. Price £3 3s.

WITH the appearance a few months ago of the third volume of Mr. Fred Clements' "Blast-furnace Practice," this important work achieved completion. The volume deals more particularly with the subject denoted by the title of the work as a whole than the previous volumes, for it is devoted to the operation of blast-furnaces. Its predecessors cleared the way, by dealing, as they did, with general principles, and the source, preparation and handling of raw materials—Vol. I.—and the design of plant and equipment—Vol. II. Incidentally, and as the three volumes are purchasable separately, it is to be regretted that the publishers, in the titles and half-titles of the present volume have omitted all reference to the previous volumes, the existence and scope of which were duly recorded in the preliminary pages of the first two volumes.

It is not often that an industry is endowed with so comprehensive and authoritative a work as this. In the iron trade there has been nothing like it since Percy's classical, but necessarily out-of-date, book appeared. The metallurgy of iron has made immense progress since that date. Has British practice made a corresponding advance? Judged by the output statistics published from month to month by the National Federation of Iron and Steel Manufacturers it is, to say the least of it, doubtful. Measured against the progress made by other nations it is sadly disconcerting to find that the average daily output of a British blast-furnace is well below 150 tons of pig iron. We have efficient and well-found furnaces producing very much more than this insignificant figure. There must, therefore, be many more producing considerably less. The average on the Continent is much higher. In America it is higher than it is on the Continent. If Mr. Clements' book helps to bring British practice up to a higher and more efficient level of production his labour will not have been in vain.

The present volume begins with the considerations which govern the calculation of the blast-furnace burden, and in the very first page the author stresses the paramount importance of securing uniformity in the quality of the raw materials, a point to which the utmost attention is directed in America. While recognising the difficulties of attaining this desirable ideal in British practice, where low-grade native ores of widely differing chemical and physical properties have to be dealt with, Mr. Clements says that practice at many existing plants could be "greatly improved" and that no new furnace installation should be projected without due regard to this important and vital aspect. In the many schemes for the "rationalisation" of the British iron trade now afoot, or under contemplation, it is sincerely to be desired that such—by no means insuperable—difficulties will be born in mind and duly surmounted.

After proceeding with the theoretical considerations on which the calculation of the burden is based, and the method of making those calculations, the control of the furnace temperature and the physical conditions come under review, followed by the discussion of the problems which confront a blast-furnace manager when blowing-in, damping down and blowing-out have to be undertaken. The latter are unfortunately current practice in the British pig iron trade and tend, to the prejudice of efficient working, to become all too common features in industry.

In the subsequent chapters Mr. Clements deals with the day-to-day problems of the furnace, and of the stoves, themselves; with safety and hygiene; with the economics of labour; with the keeping of operating costs and records—without which no proper control can be exercised—and with the cleaning of blast-furnace gas. This important aspect is adequately dealt with in a chapter extending to fifty pages, all packed with information. An even longer chapter deals with the use of blast-furnace gas in the generation of power. It is, indeed, to such uses

combined with the economic application of coke oven gases, that blast-furnace practice has to look for the bulk of the economies needed to enable it to compete, in point of efficient production, with the great American and continental plants which have carried out so far the development of such uses. The concluding chapters are devoted to the utilisation of flue dust; to that of blast-furnace slag, a subject which Mr. Clements has, with the happiest results, greatly developed at the Park Gate works over which he presides, and to two branches of blast-furnace practice, respecting which the information available has hitherto been scattered and insufficient—the manufacture of ferro-manganese and other ferro-alloys and the production of charcoal and electric pig iron.

In this, the third and last, volume of a monumental work, the author has maintained the high standard reached by the first two. The interest attaching to "Blast-furnace Practice" is cosmopolitan. The work serves as a guide to practice, all the world over—amongst our Dominions, as amongst other countries, with those with which we seek to co-operate as with those with which we have to compete. That our competitors will avail themselves of the wealth of information which Mr. Clements has embodied in his three volumes need not be doubted. It is open for us to do the same. We have now a text book, complete in detail and extensive in scope, suggestive and stimulating, and designed plainly to help the industry to which it has been devoted. It devolves on that industry to make as much use of Mr. Clements' book as possible. It is at least certain that other nations will not fail to value it, while failure on our own part to do so can but increase the handicap under which the British pig iron industry labours and which Mr. Clements has done his best to remove in a work that redounds to his credit and should enhance our own.

Modern Bridge Construction. By F. JOHNSTONE TAYLOR. London: Crosby Lockwood and Son. 1930. Price 15s. net.

ALTHOUGH at first sight it seems impossible in this short treatise of 235 pages in any sense to cover the subject of bridge construction, with no obvious and important omission in the range of structures usually included in such a work, there is some force in the author's contention that specialised practice in respect of steel and ferro-concrete bridges, coupled with the fact that "men can be readily hired to make calculations," justifies an attempt to serve the needs of engineers ". . . such as consultants, railway engineers, municipal engineers, and those concerned with rivers and harbours, who have from time to time to deal with bridge construction," and of students who do not intend to specialise in bridge work. At the same time it is to be feared that the author's standpoint is too much that of the commercially minded engineer, and that in regard to steel and ferro-concrete bridges he is thinking of manufacturing firms rather than of independent engineers, while another passage in his preface suggests that he under-estimates the importance of certain kinds of computations, or confuses designing proper with the computations of a later stage. On page 30 he states in regard to small steel bridges that "it is not necessary to discuss these simple structures from a design point of view, because suitable scantlings for average conditions can always be obtained from the section books of the steel makers." Yet very much money has been wasted as the result of neglecting to design such bridges properly.

Before considering in what the value of this book consists, it is necessary to point out that the author completely ignores the primary elements of bridge design, in respect of sites, rivers, competing types, numbers of spans, and so forth; also, to a large extent, in regard to design as affected by the nature of the ground. The claim, in the sub-title, that the book sets forth the elements of bridge design cannot therefore be sustained, nor is the space devoted to design more than sufficient to present the normal treatment of the simpler cases of computation. In regard to the range of structures considered, the author's remarkable opinion, that the masonry arch ". . . . is passing, if it has not already passed, from the 'practical politics' of the engineer . . .," has not deterred him from dealing very usefully with masonry bridges; but he dismisses timber bridges in seven words.

It has been necessary to consider here the author's attitude towards his subject, in order that it may be recommended that the book shall not be used quite in the manner suggested by the preface. Rather, it may serve as a means of keeping in touch with bridge calculations, such as are now often required and with recent important practice, while enabling engineers of the classes for which it is specially intended to realise what they can do by themselves and when more highly qualified bridge engineers must be called in. For students not specialising in bridge work it is an excellent guide, while it may also be studied with advantage at the proper stage in a course of instruction in bridge engineering.

The book is well balanced, as regards both the allotment of space to the respective classes of structures and the presentment, for each class, of calculations, description, and discussion of interesting points. Many of the descriptions of works are taken with due acknowledgment, from the "Proceedings" of the Institution of Civil Engineers, cited as "Trans. I.C.E.," and from THE ENGINEER and *Engineering*. The opening bridges dealt with include the bascule, drawbridge, and vertical lift types, and, at greater length, swing bridges. A feature that deserves special mention is the chapter on Erection Methods in Bridge Work, while considerable space is usefully given to constructional details of steel bridges. There are more than a hundred well-drawn and well-reproduced illustrations, which the author has selected with good judgment. Properly used, not as an aid to the "practical politics" of engineering but with a just sense of professional responsibility, this book should prove of service to many engineers, while it is worth reading as engineering literature.

Metalliferous Mine Surveying. By THOMAS G. HANTON. London: Crosby Lockwood and Son. 1930. Price 15s. net.

THERE is already in existence a very large number of publications dealing with mine surveying, ranging from what may be called the standard British work on the subject by the late Bennett H. Brough, now in its 17th Edition, to treatises, articles and communications to technical societies and to the technical Press, dealing usually with one particular aspect of the subject. The justification for an additional book on the subject must, therefore, be sought in novelty either of treatment or of matter, and it may be said at the outset that in this respect the work before us is deficient; indeed, so far from being up to date, it is, in some respects, behind the times, certainly as far as modern British practice is concerned. This defect appears particularly in the author's description of a theodolite, the type figured and described by him being a distinctly old-fashioned one, the numerous improvements which have been specified in recent years, more particularly by the late Professor L. H. Cooke ("Trans.," Inst. Min. Met., Vol. XXII., p. 326) not being mentioned. Throughout the whole work similar points are noticeable. The author has described ordinary practice, presumably Australian practice, quite well and with remarkably few mistakes of any importance, but is silent on many of the higher points of surveying practice. Thus, he dismisses one of the most important problems of the surveyor, namely, that of determining the true meridian, in a few lines over one page, and it need hardly be said that the instructions given for making this important observation are far too sketchy to be of any real use to the surveyor, whilst the methods of calculation are not even referred to. The author does, indeed, refer to the method of plotting by rectangular co-ordinates, but does not discuss the great value of this method in the calculation of areas. Upon the whole, it may fairly be said that whilst the surveyor who is guided only by it will be able to do his everyday work quite satisfactorily, he will not have the information necessary to enable him to attain to any of the higher flights in his profession.

SHORT NOTICES.

History of the Canterbury and Whitstable Railway. By Rev. Reginald B. Fellows, M.A. Canterbury: J. A. Jennings, Ltd. 1930. Price 6s.—The Canterbury and Whitstable Railway has the proud distinction of being the third public railway to employ the steam locomotive and the first in England on which ordinary passengers were hauled by steam power. It was opened just one hundred years ago on May 3rd, 1830, and on the next day the passenger and goods services were started. It was a little over six miles long, of which the first four out of Canterbury were on inclines worked by fixed engines, whilst on the remaining two the famous "Invicta," built by Stephensons, hauled the mixed train of carriages and wagons. The locomotive was not a complete success, and Mr. Warren has suggested that it was only recommended by George Stephenson with the object of introducing steam locomotion in the South of England. The railway was not a success financially during its fourteen years of independent existence. In 1844 it was leased to the South-Eastern Railway. Only then did it succeed in paying off all its debts and securing a small dividend for the enterprising people who found the money for its construction. In 1853 the South-Eastern Railway purchased the property outright. In this quarto volume Mr. Fellows has collected the historical facts connected with the railway and the improvement of Whitstable Harbour associated with it; several pictorial illustrations and a number of plans are included. It was very fitting that a history of the line should appear in its centenary year, and all who take an interest in the development of railways will be grateful to the author for his investigations and welcome the appearance of his book.

Autobiographical and Other Writings. By Alan A. Campbell Swinton. London: Longmans, Green and Co. 1930. Price 10s. 6d.—All who knew Campbell Swinton—and his friends were many—will welcome this little autobiographical volume. He died so recently—only in February last—that his own voice seems to sound through the written words as he tells again the anecdotes that he loved or recounts his experiences with photography from its early days. He had many eminent acquaintances and many famous friends, and all of them at some time in their lives entered his portrait gallery. In this book will be found only a few reproductions from his collection, but it will amuse and interest many to look back upon portraits taken many years ago. The volume is called autobiographical, but it is biographical too, for Campbell Swinton has set down here anecdotes and little sketches of many of the victims of his camera. Take it for all in all, it is just such a book as one would have expected its author to write, and all who knew him well will rejoice to have such a souvenir of an old friend, whilst those to whom he was a stranger will find in it many little comments upon men and matters that are worth reading.

The Theory of Electrical Artificial Lines and Filters. By A. C. Bartlett. London: Chapman and Hall. Price 13s. 6d.—The author of this book explains that in modern telegraphy and telephony, both wired and wireless networks, such as artificial transmission lines, line balancers, filters and phase shifters, are becoming of increasing importance, and a knowledge of their action is becoming essential to many engineers. In the book an attempt is made to give a general introduction to the theory of such networks in order that the reader may be in a position to study other literature on the subject. At the outset the author deals with the theory of T and π section artificial lines. He then gives the general theory of repeated networks and deals with the most general type of artificial line. A third chapter is devoted to ladder networks and generalisations of the T and π section artificial lines. These three chapters are to be regarded as the most important. The chapter on filters is restricted to a treatment of the simpler types. Another chapter deals with the Homographic Transformation and Cycle Diagrams, whilst the final chapter—IX.—is devoted to the theory of the multi-stage amplifier.

Henley's Twentieth Century Formulas, Recipes, and Processes. Edited by G. D. Hiscox. London: Crosby Lockwood and Son, Stationers' Hall-court, E.C. Price 16s. net.—At first glance this book seems a bewildering conglomeration of formulas, recipes, &c., but upon careful examination one finds much valuable information and interesting reading upon a large variety of subjects. It is claimed to contain some 10,000 household, workshop and scientific formulas, trade secrets, chemical recipes, processes and money-saving ideas, and if one can judge by the excellent index this is not an erroneous statement. Amongst the subjects dealt with are Alloys, Cements, Paints, Glass, Enamels, Glues, Leather, Inks, Dyes, Soap, Cosmetics, Rubber, Woods, &c. As a book for general reference, this publication may be recommended, for the information it contains is sure to be of service sooner or later in one of the problems which frequently arise in all works, offices and homes.

BOOKS RECEIVED.

Gasfernversorgung. By A. Kemper. Halle (Saale): Wilhelm Knapp. Price 10·20 marks.

Water Power Around the World. Ferrum. London: Perrin's, Ltd., 3, Central-buildings, S.W. 1.

Motor Repair Manual. Fifth edition. London: Temple Press, Ltd., 5–15, Rosebery-avenue, E.C. 1. Price 2s. 6d. net.

Starrpunkt und Viskosität Bituminöser Stoffe. By H. Metzger. Halle (Saale): Wilhelm Knapp. Price 5·60 marks.

Ausgewählte Schweisskonstruktionen. Vol. 1, Stahlbau. By Dipl.-Ing. O. Bondy. Berlin: V.D.I. Verlag G.m.b.H., N.W. 7. Price 12 marks.

The Spirit of Chemistry. By A. Findlay. London: Longmans, Green and Co., Ltd., 39, Paternoster-row, E.C. 4. Price 10s. 6d. net.

Kinematics of Machines. Second edition. By G. L. Guillet. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 15s. net.

Economic Conditions in Portugal. Report by A. H. W. King. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 2s. net.

Rubber: An Economic and Statistical Study. By José Carlos de Macedo Sowres. London: Constable and Co., Ltd., 10, Orange-street, W.C. 2. Price 6s. net.

Flood Flows: A Study of Frequencies and Magnitudes. By A. Hagen, Sc.D. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 20s. net.

Definitions and Formulæ for Students: Electrical Installation Work. By F. P. Sexton. London: Sir Isaac Pitman and Sons, Ltd., Parker-street, Kingsway, W.C. 2. Price 6d. net.

Technical Data on Fuel. Second edition. Edited by E. M. Spiers. London: British National Committee World Power Conference, 63, Lincoln's Inn-fields, W.C. 2. Price 12s. 6d. net.

The National Physical Laboratory: Report on the Engineering Department for the Year 1929. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 2s. net.

Experimental Researches on Turbine Pumps. Report No. 1 of the Yokohama Technological College. By Masanao Yendo. Yokohama: The Yokohama Technological College, Japan.

Flame-proof Electrical Apparatus for Use in Coal Mines. Summarising Report by I. F. C. Statham and R. V. Wheeler. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 6d. net.

Geodesy, Including Astronomical Observations, Gravity Measurements, and Method of Least Squares. Second edition. By G. L. Hosmer. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 22s. 6d. net.

THERE has, according to the official annual survey of the alkali industry, been a considerable decrease in the amount of salt decomposed at alkali and copper—wet process—works in every district but one. The reason for this is twofold. First, the increased supplies of pure acid, made synthetically, and, second, the extension of the use of sulphuric acid instead of hydrochloric acid for pickling iron plates. The latter reason bids fair to result in the closing down of more than one works of this class.

Three New Fire Fighting Appliances.

RECENTLY we had an opportunity of inspecting at work three new fire-fighting appliances which have been produced by Merryweather and Sons, Ltd., of Greenwich. They comprise a petrol-driven fire-engine with a pump worked through a two-speed gear-box, a light petrol-driven pump for trailing behind any other vehicle, and a turntable ladder provided with its own pump. We illustrate all three machines herewith.

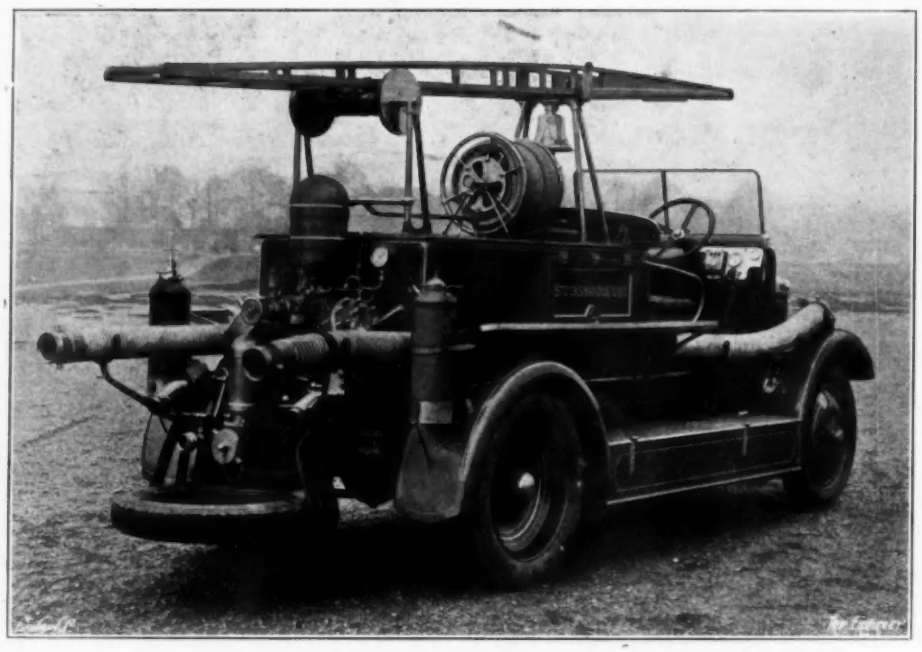


FIG. 1—FIRE ENGINE WITH TWO-SPEED GEARED PUMP

The first of these machines, the two-speed geared pump, is illustrated in Fig. 1, and is capable of delivering a maximum of 390 gallons of water a minute against a pressure of 98 lb. per square inch. It is driven by a 40 horse-power petrol engine and has a three-cylinder Hatfield fire pump. Its peculiarity is, of course, the adoption of a two-speed gear-box in the drive between the engine and the pump, which is quite distinct from the gear-box used for travelling purposes. The reason for this arrangement is that there may be occasions when it is necessary for the engine to pump against very considerable pressures, when the torque of a petrol engine would be inadequate at the necessarily reduced speed of the pump. In other words, as the pressure rises the quantity of water must be reduced, or the horse-power required to produce the jet would be beyond the capacity of the engine.

The conditions of working are well shown in the graph, which we reproduce in Fig. 2. It will be seen reading from the right that when in high gear the engine can produce enough power to give a pressure of 98 lb. per square inch when pumping 390 gallons per minute, and that the pressure will rise to 115 lb. if the delivery is restricted to 300 gallons. At this point, however, the engine is nearly overpowered, so the gear ratio is changed, the engine speed rises and a pressure of 140 lb. is obtained with the same delivery. Then, by reducing the quantity of water being pumped, the pressure can be raised to 165 lb. per square inch. It will be noted that throughout this wide range of outputs, the efficiency varies only by about 10 per cent.

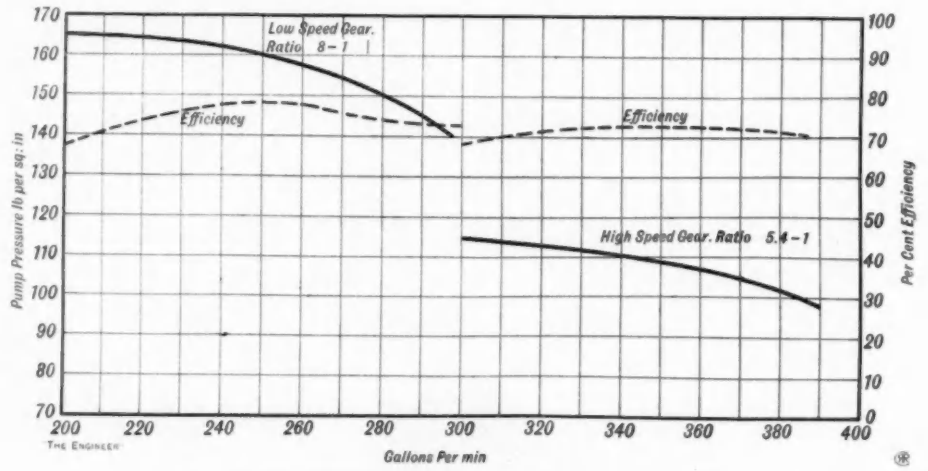


FIG. 2—DELIVERY PRESSURE AND EFFICIENCY CURVES

The pump itself is of the makers' Hatfield type, with three barrels, 6in. in diameter by 4in. stroke, all worked off one crank pin. It is self-priming, no auxiliary air pump being required, and it is fitted with an automatic by-pass, which prevents excessive pressure in the hose and enables shut-off nozzles to be used. It is also capable of making full use of whatever pressure exists in water supply mains when the suction is direct-coupled to a hydrant. The automatic by-pass comprises a spring-loaded gun-metal valve closing a passage between the suction and delivery chambers of the pump, and is brought into action when shut-off nozzles are being employed, or when the water delivery is small. The by-pass, which returns water from the delivery to the suction side of the pump, may be used by hand at any pressure, and operates automatically after the pressure has risen to a predetermined height. The suction and delivery valves are of the rubber disc type.

The engine is of 40 horse-power and has four cylinders, 3½in. bore by 4½in. stroke, and is of normal design with detachable cylinder heads. The gear-box gives four speeds forward and a reverse. It has ball bearings throughout. The wheels are of pressed steel and are fitted with tires 33in. by 5in. in front and 33in. by 6in. on the drivers.

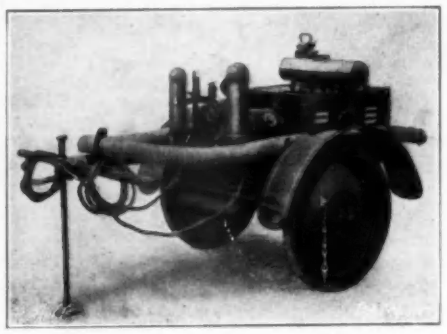


FIG. 4—LIGHT TRAILER PUMP

The trailer pump—see Fig. 4—is a new design and is intended either for man-handling or for trailing behind any other vehicle. It has the merit that it can be manœuvred into confined spaces where a full-sized engine could not be accommodated. It has a 20 horse-power engine and is capable of delivering 165 gallons a minute against a pressure of 125 lb. per square inch. The pump of this machine also is of the three-cylinder Hatfield type, but has only one speed gear, which is of the silent chain type. The engine is of the four-cylinder monobloc type, and is provided with cylinders having a 69 mm. bore and a 100 mm. stroke. It is fitted with magneto ignition, forced lubrication and an automatic carburetter. The cooling system comprises a brass tank with pipe connections to the water jackets. This tank provides a supply of water enabling the engine to be started up and run for short periods without the supply from the pump. When the pump is working, the tank can be kept overflowing from the main pump, the temperature of the overflow being regulated by a valve provided for this purpose. The framework is of steel throughout and is mounted on springs. Adjustable props are provided for steadying the machine when it is uncoupled from the towing vehicle, and its wheels are provided with powerful brakes.

The turntable ladder, illustrated in Fig. 3 below, has been specially built for the Margate fire brigade, and combines a ladder and pump on one chassis. The chassis is of the Merryweather Albion type, with a pressed steel frame and solid rubber tires on the wheels. The petrol engine is of the four-cylinder type and has cylinders 4½in.

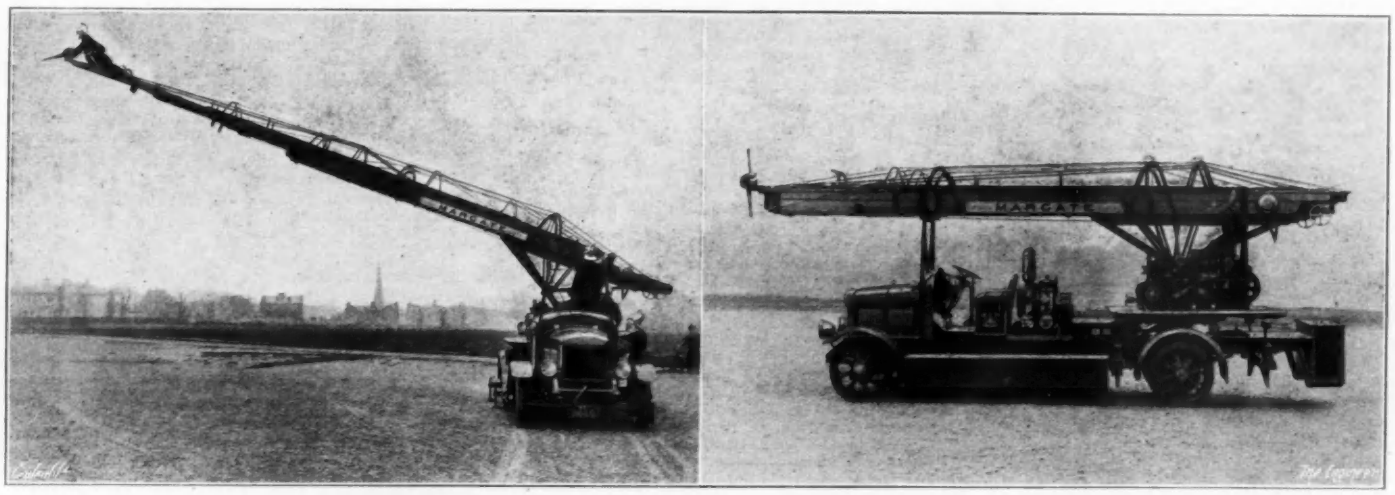


FIG. 3—TURNTABLE LADDER AND FIRE PUMP SHOWING LADDER EXTENDED AND FOLDED

bore by 5½in. stroke. It is capable of developing 70 B.H.P. Dual ignition is provided. The change-speed gear-box gives four speeds forward and a reverse. It drives the road wheels by a propeller shaft and there is also a gear for

driving a lay shaft running along the off side of the frame. This shaft is used to work the pump and the ladder mechanism.

The pump itself is of the Hatfield type and is driven by a silent chain. It is capable of delivering 275 gallons a minute against a pressure of 120 lb. per square inch. It is fitted with two suction branches and two delivery outlets, one on each side of the pump. Each delivery is equipped with a separate shut-off valve. The pump has the usual automatic by-pass to prevent excessive pressure in the hose.

The ladder on the turntable at the rear of the chassis is in four telescopic sections and is capable of extension to a total height of 85ft. The sides are of Oregon pine and the rungs of oak. The rungs are set in malleable iron sockets, which obviates the necessity for boring the sides, and also facilitates the renewal of damaged rungs. The three lower sections are trussed with steel tension rods, while the upper section has a tubular truss of solid-drawn steel tube. The first section also has a system of diagonal bracing.

The ladder is manœuvred entirely by the main engine, through the lay shaft, although there is a hand gear for emergencies. For raising it from the stowed position, there are two buttress-threaded screws, which are plainly visible in Fig. 6. The several sections are extended by

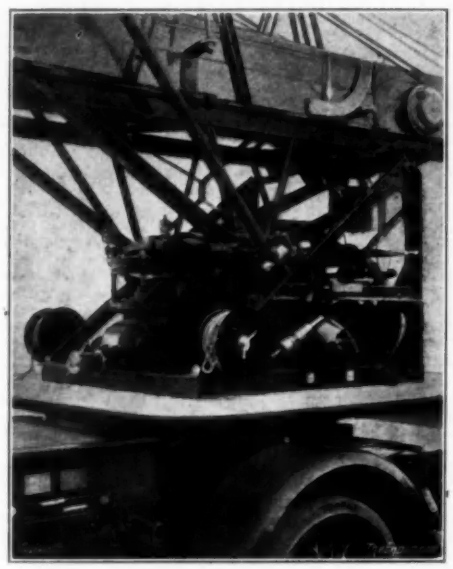


FIG. 6—TURNTABLE MECHANISM

a winch and wire ropes, which draw them out in succession, and rotation is effected by a worm and worm-wheel on the turntable. The turntable, is carried on roller bearings. At the end of the ladder there is permanently fixed a double swivelling water tower nozzle.

In order to preclude the possibility of the machine being overturned by the ladder being luffed out too far at any given extension, an automatic device operated by cams connected with the driving gears is provided. A pointer swinging over a graduated quadrant on the main ladder shows the angle of elevation, and a bell rings when the rungs are in position for raising the ladders. The amount of extension is shown automatically, and the ladders cannot be over-extended owing to the provision of automatic stops worked by cams. These stops are enclosed to prevent unauthorised interference. When the ladders are extended they can be adjusted to a considerable angle on either side when working on uneven ground by means of the plumbing gear provided. For taking the weight of the extended ladders off the springs and tires, four hinged jacking-up screws are fitted to the main framing.

There is accommodation on the engine for eight firemen besides the officer and driver on the front seat.

Ocean-going Destroyers for the Argentine Navy.

IN the course of the description of the shipyards and engine works of J. Samuel White and Co., Ltd., at Cowes, I.O.W., which appeared in our issues of November 29th and December 6th, 1929, we had occasion to refer to the three flotilla leaders for the Argentine Government, which were ordered in June, 1927, and were delivered towards the end of last year. The new destroyers, "Tucuman," "Mendoza," and "La Rioja," the first two of which are illustrated on page 94, have now safely arrived in the Argentine, and have been commissioned to take up their appropriate places as flotilla leaders in the Argentine Navy. The voyage of 5860 miles from Lisbon to Bahia Blanca across the Atlantic was accomplished without refuelling, and is, we are informed, a much longer non-stop steaming performance than has before been accomplished by a destroyer. On arrival the machinery of the three ships was found to be in perfect order, while enough fuel remained in the bunkers for more than another 1000 miles' steaming. There was also two further days' supply of fresh meat in the cold stores of the ships.

DESIGN AND HULL PARTICULARS.

The design and specification for the destroyers were prepared by the builders to meet the requirements of the Argentine Government, and the principal features embodied in the design included high speed, powerful armament, and ability to keep at sea in all weathers for long periods without having to refuel. The official trials, which were of an exacting nature, showed that all these aims were realised to the full, and results satisfactory to all concerned with ample margins in hand were obtained.

The principal particulars of the hull are as follows:—Length on load water line, 330ft. 9in.; breadth moulded, 31ft. 9in.; depth, 19ft. 9in.; load displacement, 2300 tons; load draught, 12ft. 6in.

ARMAMENT.

The main armament consists of five 120 mm., 45-calibre guns, one 76 mm. anti-aircraft gun, and two 40 mm. pom-pom guns, with high-angle mountings. The 120 mm. guns are arranged two at the fore end and two at the aft end of the vessels, in superimposed positions, the remaining gun being mounted between the funnels. For these guns very large angles of training have been arranged. The 76 mm. anti-aircraft gun is placed abaft the after funnel, and it has a practically unobstructed field of high-angle fire. Four machine guns with naval mountings and two bomb throwers complete the gun armament. On the middle line over the engine-room there are placed two sets of 21in. triple revolving torpedo tubes, which are arranged to project torpedoes over either beam.

The magazines and shell rooms for the stowage of ammunition are arranged forward and aft. The supply of ammunition to the guns is furnished by means of hand-up scuttles and whips. The torpedo bodies are stowed in the torpedo tubes and the heads in the steering gear compartment. A bow paravane mine sweep gear is fitted to each vessel. The armament and ammunition for all three vessels was supplied and fitted by Vickers-Armstrongs, Ltd.

The director gun and torpedo fire control system was installed by Messrs. Hazemeyer, of Holland, and it comprises the necessary instruments, fitted in a fire control room on the forecastle deck under the bridge. In connection with the director control, two 13ft. rangefinders are provided, one on the bridge and the other on the deck-house aft. Local electrical firing of the guns has also been arranged for.

Submarine signalling, listening and depth-sounding equipment of the latest type was supplied and fitted by the Signal Gesellschaft, of Bremen. The wireless telegraphy installation is of the Marconi Wireless Telegraph Company's type. The main wireless station is situated on the bridge, while a secondary station is arranged in the after deck-house. Both long and short-wave transmitters and receivers are fitted, together with a direction-finding apparatus, and all the instruments are of the latest type.

A gyro compass of the Anschütz "U" pattern is fixed in a special gyro compartment, with additional gyro repeater fittings on the navigating bridge.

One 600 mm. high-intensity searchlight projector with mechanical control is arranged upon a raised platform over the engine casing, while two 300 mm. signalling projectors are carried, one at each side of the navigating bridge. The searchlight projectors were supplied by the Sperry Gyroscope Company, Ltd.

There is accommodation for 160 officers and men. The petty officers' and men's quarters are arranged forward on the lower deck and in the long forecastle, while the warrant officers' quarters are also situated forward, and include a large mess room in the forecastle deck-house.

PROPELLING MACHINERY.

The propelling machinery consists of two sets of "Parsons" type turbines, each set being coupled through reduction gearing to its respective propeller shafting, and comprising a high-pressure and a low-pressure turbine, incorporated with which is an astern turbine.

Steam is supplied by four water-tube boilers of the three drum type, having a working pressure of 250 lb. per square inch, and arranged for oil firing on the "J. Samuel White" system.

The high-pressure turbine is fitted with an impulse wheel, which is followed by a number of stages of reaction blading for obtaining economy at cruising powers. These reaction stages are by-passed at full power, and it may be observed that the fuel consumption obtained on the cruising trials was such that the guaranteed radius of action of 7000 miles was exceeded by a substantial margin.

For cruising powers, steam is admitted to the impulse blading through nozzles which are arranged in three groups of ten, eight, and six jets respectively, each group being controlled by a valve which enables various combinations of nozzles to be obtained to suit the power required.

There are also four main steam inlets to the high-pressure turbine arranged at suitable expansions of the reaction blading, each controlled by a valve, for obtaining powers higher than about 7500 S.H.P.

The high-pressure rotor is of drum construction, the aft spindle and drum consisting of a combined forging, the forward end and spindle being spigoted into the drum. The impulse wheel is forged integrally with the forward end and spindle, but the rotor dummy is a separate ring attached to the impulse wheel.

The impulse blading is machined from combined blade and packing sections, and there are three rows of impulse blades in the rotor and two in the cylinder.

The reaction blading is arranged in two groups of nine rows each and one group of seven rows. These three groups constitute the low-power and cruising stages with a steam inlet associated with each of them. There are also two groups of four rows each and four groups of three rows each, these six groups being full-power stages and associated with the full-power inlet.

The low-pressure turbine is of the double-flow type, and the steam inlet, which receives the steam from the high-pressure turbine, is situated in the centre of the blading, so that the steam flows both ways and thus overcomes any necessity for dummies. The blading is of all-reaction type.

The astern turbine is incorporated with the low-pressure ahead turbine and it consists of an imupls wheel followed by reaction blading, which is arranged in four expansions. The nozzles through which steam passes to the astern impulse blades, are so arranged that one group is in the top half of the cylinder, and they are uncontrolled excepting by the astern regulating valve. There are also two groups in the bottom half of the cylinder, each controlled by a valve.

The low-pressure and astern rotor is built up with its wheels shrunk and secured on to the spindle, while the astern dummy is a separate ring secured to the impulse wheel. The ahead reaction blading is arranged in two flows, each flow has three expansions of two rows each and seven expansions of one row each.

The revolutions of the propeller shafting are 355 per minute, the corresponding speeds of the turbine being 2330 and 1829 revolutions per minute for the high-pressure and low-pressure turbines respectively. The propellers are three-bladed and were cast in special bronze by J. Stone and Co., Ltd., of Deptford.

The turbines are coupled to the gearing through flexible claw couplings, the pitch circle diameter of the main gear wheel being 87·19in. with 13·28in. and 16·92in. for the high-pressure and low-pressure pinions respectively.

A main gear wheel of the built-up type is employed, the spindle having flanges to which are secured steel discs which, in turn, are bolted to the shroud. The discs are stiffened by cast steel distance pieces between them. The pinions are of nickel steel and each is carried in three bearings. At the gear case at the after end of the high-pressure pinion the turning gear is arranged, to which the turning wheel may be coupled by a sliding shaft and put in and out of gear as required. The main thrust blocks are of the Michell type, as are also the adjusting blocks of the turbines. All the main bearings of the turbines and gearing, also the sprayers for the lubrication of the pinion and gear wheel teeth and the thrust blocks are supplied with oil from a pressure system. Three "Weir" forced lubrication pumps, two of which are capable of supplying the whole of the oil required, the remaining one being a standby, are fitted, together with a complete system of coolers, oil drain tanks, suction strainers and discharge filters suitably cross connected. The oil coolers are of the "Serck" type with sea water circulation.

ENGINE-ROOM AUXILIARY MACHINERY.

The condensers are of the Weir regenerative type and the main circulating pumps are of the "Weir" vertical spindle turbine-driven type, each unit consisting of an impulse turbine driving a centrifugal pump through reduction gearing. The feed system is of the "Weir" closed type.

BOILERS.

There are four boilers, arranged one in each of the forward and aft and two in the middle boiler-rooms. Each boiler has thirteen burners, each of about 900 lb. capacity. For supplying oil to the burners, there are oil fuel pumps of the "Weir" type, two in each boiler-room, one pump in each boiler-room acting as a standby. Oil is drawn from the tanks through suction strainers and discharged to heaters of the "U" tube type, there being two in each boiler-room, and is delivered to the burners. Filters are provided each side of the heaters.

The oil is initially warmed by a steam coil fitted in the neighbourhood of the suction pipe in one tank and supplied with steam from a small auxiliary boiler should there be no steam available from the main boilers. This enables oil to be circulated through the heaters and back to the tank. When the oil has been sufficiently raised in temperature, a quantity is circulated to any other tank as required, thus warming the main body of the oil and enabling it in turn to be circulated through the heater and back to the tank in the same way.

To raise steam on the main boilers from cold, a small auxiliary boiler is fitted in the middle boiler-room. It is also used for supplying steam to the accommodation radiators when the main boilers are shut down, and it is arranged for both coal and oil firing, and is fired with coal until sufficient steam is available to bring the oil fuel system into operation.

Four auxiliary feed pumps are fitted in the boiler-rooms, one to each boiler. They are capable of supplying the whole of the feed required for full power should it become necessary to bring these pumps into action.

A small air compressor is fitted in the middle boiler-room for supplying air under pressure for cleaning boiler tubes, and the torpedo-charging air compressor is also placed in the engine-room.

The air supply is provided by eight "Allen" type turbine-driven fans of the vertical spindle type, the units consisting of an impulse turbine driving the fan through helical reduction gearing.

The electric installations of the destroyers is very complete and is arranged on an up-to-date ring main system. The electrical energy is generated by two sets of 35 kW turbine-driven sets and one 15 kW Diesel set. There are over 50 motors and generators of various sizes, not including table fans, &c. Several of these motors are used for the engine-room auxiliaries, fresh water and sanitary pumps, galley blowers, motor generators for wireless and for submarine signalling, fire control, low-pressure systems, &c. The main switchboards were supplied by the Park Royal Engineering Company, Ltd., also the boards for controlling all the internal communication circuits, including loud speaking and fire control telephones, gongs, electric log, helm indicator, &c. &c. In all, about 500 electric lamps are fitted throughout each vessel.

TRIAL PERFORMANCE.

After completion each vessel was taken on a measured mile course for progressive speed trials and for consumption trials at full and cruising speeds. The performances of the "Mendoza," "Tucuman" and "La Rioja" were very similar, and the figures given below may be taken to represent all three vessels.

The highest mean speed attained on the measured mile, both with and against the tide, was 39·4 knots. This figure exceeded the contract speed by nearly 3¼ knots without, however, running the machinery in excess of the designed power. On the full-speed oil fuel consumption trials the oil burned was 0·9 lb. per horse-power per hour. In order to determine the radius of action of the vessels at their designed cruising speed, a 12-hours' fuel consumption trial was run at a speed of about 14 knots. The ability to steam for great distances without re-fuelling is one of the features of the designs of the vessels, and they are able to keep at sea for a much longer time than has hitherto been possible with torpedo-boat destroyers or flotilla leaders.

Three-Winding Transformers.

THE original conception of a transformer was one in which there are two windings on the same core. A development of this arrangement was the auto-transformer, in which the two windings are electrically coupled. By this arrangement considerable economy can be effected for a certain range of voltage ratio. If the voltage ratio is nearly unity an auto-transformer is very economical as compared with a two-winding transformer, but as the voltage ratio increases the economy becomes less until at a certain point there is no advantage in using an auto-transformer. Many special transformer connections have been devised, but we are only concerned here with the development of three-winding transformers. Occasionally it has been desired to take a supply from a high-pressure system for the purpose of supplying power at, say, 2200 volts for induction motors, for instance, and at the same time to give a lighting supply at a lower voltage from the

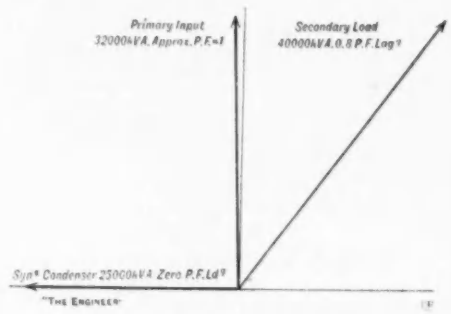


FIG. 1—TRANSFORMER VECTOR DIAGRAM

same transformer. In order to do this a small auxiliary secondary winding has been provided for the lighting supply. But for several reasons this practice is undesirable. The lighting supply may, for example, be required when there is no motor load, thus necessitating the large transformer with its high no-load losses remaining in circuit. Furthermore, the regulation on the lighting circuit is none too good. This arrangement was perhaps the first application of three-winding transformers.

Within recent times it has become more and more customary to construct transformers with both the high-voltage and low-voltage windings star connected. At very high voltages, and particularly in the case of transformers for comparatively small outputs, this practice results in considerable economy in the transformer winding, for with the star connection the current is $\sqrt{3}$ times the value it would have with the delta connection, whilst the number of turns is $\frac{1}{\sqrt{3}}$ times the number needed for the delta connection. This results in a considerable

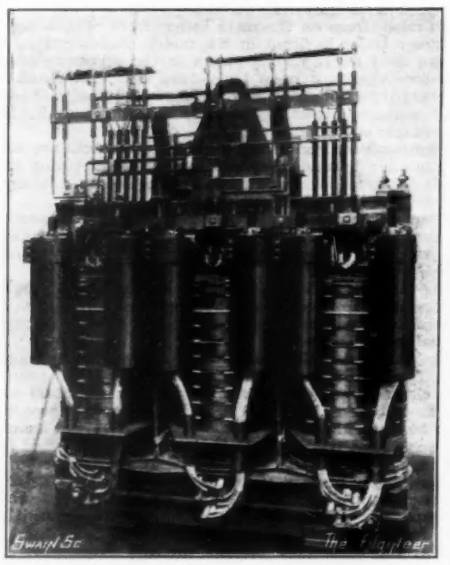


FIG. 2—1000-kVA THREE-WINDING TRANSFORMER

improvement in the space factor and therefore a cheaper and more efficient transformer.

Another advantage of the star connection is that the neutral can be solidly earthed, a practice that is now almost standard for very high-voltage transmission systems. But it is well known that in certain cases where star-star connected transformers are employed trouble may be experienced owing to the fact that there is no local circuit in which triple-frequency current can flow. Third harmonic voltages superimpose themselves on the line voltage, and if the neutral is not earthed these voltages cause the neutra to oscillate about earth potential. This applies to three-phase banks of single-phase transformers as well as three-phase transformers of the shell type, but in the case of three-phase units of the three-limb core type, owing to the very close interlinking of the three phases, the trouble does not arise.

In order to avoid the trouble on transformers with the windings star-star connected it has been customary to provide an auxiliary delta-connected winding so as to open a path for the triple-frequency current and thereby eliminate the triple-frequency voltages in the main windings. In the ordinary way this third or tertiary winding has been connected in a closed delta, and in the case of a three-phase transformer no connection from it has been brought out of the tank. Its voltage is determined arbitrarily by the designer. The size of the winding is not determined simply by consideration of the triple-frequency current that would flow in it, but by a much more serious factor. When one line on the main supply either on the high-voltage or low-voltage side becomes earthed it causes a short circuit current to flow in the delta-connected tertiary winding, and the value of this current depends largely on the impedance between the tertiary winding and the winding on which the earth has occurred. Suppose a generating station is supplying a star-star-connected transformer having a tertiary winding

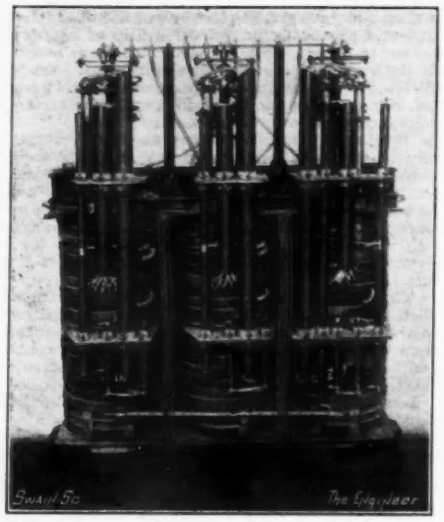


FIG. 3—SMALL THREE-WINDING TRANSFORMER

and that the neutral of the station is isolated, the transformer neutral earthed and the secondary neutral either isolated or earthed, then if an earth occurs on the primary line a very heavy current will flow in the tertiary winding. This is the worst possible condition, but it is not a very probable one, because it is unlikely that the generating station neutral will be unearthed.

A very common condition is that in which the generator neutral is earthed, the transformer neutral isolated, and the secondary neutral earthed. If the secondary line goes to earth under these conditions the tertiary current is considerably less than it is in the case mentioned above, but notwithstanding, this winding is subjected to a serious condition which demands careful attention on the part of the designer. All the possible conditions of the system as regards the earthing of neutrals must be known by the designer, and it is not sufficient for the customer to specify an arbitrary equivalent rating for the tertiary winding. This winding is, of course, always designed to be safe under the worst possible conditions, and in general its equivalent capacity on the basis of continuous running is about 15 per cent. of the normal output of the main transformer.

In some cases the tertiary winding has been put to useful service, as, for example, to give a local supply at a comparatively low voltage without affecting its main function of suppressing third harmonics in the main winding.

On some long high-voltage transmission systems it has been found necessary to install synchronous condensers for the purpose of controlling the power factor and stability of the system. These machines have to be supplied with power from the transmission system, and in the ordinary way a step-down transformer is necessary to provide the low voltage for the machine. It has, however, been found convenient to use the tertiary winding for this purpose, a practice that results in economy. An additional economy which is not evident at first sight is that the load required from the tertiary winding to supply the synchronous condenser is probably at zero power factor leading, whilst usually the power factor of the secondary load is lagging at 0·8 or even lower. The conditions are indicated in the vector diagram Fig. 1, from which it will be seen that the input to the primary of the transformer is at practically unity power factor. As it cannot be assumed that the synchronous condenser will always be in service, the primary and secondary windings must both have the full rated capacity, notwithstanding that under service conditions, as shown, for instance, in the vector diagram, the input to the primary winding may be considerably less than its normal rating.

The alternative to this scheme of using a three-winding transformer would be the installation of two separate two-winding transformers, but in this case advantage cannot be taken of the leading power factor of the synchronous condenser load. Taking the conditions represented in the vector diagram, the two cases can be compared by arriving at a figure representing the equivalent output of the transformers in each case as follows :—

	kVA of windings.		
	Three-winding transformers.	Two-winding transformers.	
		Main unit.	Unit to supply syn. condenser.
132-kV main winding	40,000	40,000	25,000
66-kV main winding	40,000	40,000	
11-kV winding for syn. condenser	25,000		25,000
	105,000	130,000	
Equivalent total kVA..	52,500	65,000	

Another use of three-winding transformers that is now becoming very common in connection with the interconnection of power systems is the coupling of these systems at certain points. It may be necessary to couple three systems operating at, say, 132 kV, 33 kV, and 6·6 kV, on which the operating conditions may vary. The 132-kV winding, for example, may have to supply both the 33-kV and 6·6-kV windings, or the latter may receive power from the first two windings or there may be other combinations.

In all cases of three-winding transformers and particularly those cited in the last two paragraphs the design presents an interesting problem. The three windings must be so arranged relatively to each other that the impedance with certain combinations shall produce the desired result. With a core type transformer it is not an easy matter to arrange the windings in other than a concentric manner, with perhaps the tertiary winding next to the core, the low-voltage winding outside this and the high-voltage winding outermost. Other combinations are possible, but the designer does not have a very wide field as regards the arrangement of the impedance between various combinations of the windings. On the other hand, with the shell type of construction in which the windings are interleaved, a number of different arrangements can be made, and it is a comparatively easy matter to arrive at the desired values of impedance between the windings under various conditions. A simple arrangement of the windings of a two-winding shell type transformer is L, HH, LL, HH, L. The easiest way to add a tertiary winding is to place it at the extreme ends, thus :—T, L, HH, LL, HH, L, T ; but while this does not affect the impedance between H and L, the impedance between H and T is very much higher than it is from L to T. This can be altered by again splitting the tertiary thus :—T, L, HH, T, LL, T, HH, L, T. This arrangement reduces the impedance between H to T and L to T, but the value from H to L is somewhat increased. These examples illustrate possible arrangements of three windings on shell type transformers, and they may be multiplied many times, and practically any desired set of conditions can be met by making a suitable choice of the winding arrangement.

The theory of three-winding transformers involves higher mathematics, and while it is comparatively easy to calculate the impedance between any pair of windings, assuming the other winding is idle, it is by no means easy to predetermine the conditions as regards voltage regulation when all three windings are in use. However, having calculated or tested the impedance between the three combinations of two windings, it is possible to work out the regulation under any desired combination. Coupled with the question of regulation is also that of short-circuit kVA. Although it is improbable that a short circuit would occur on two systems simultaneously, it is nevertheless possible, and the designer of the transformer must take this contingency into account. In the present state of the art of transformer design the practical considerations are thoroughly understood, and three-winding transformers

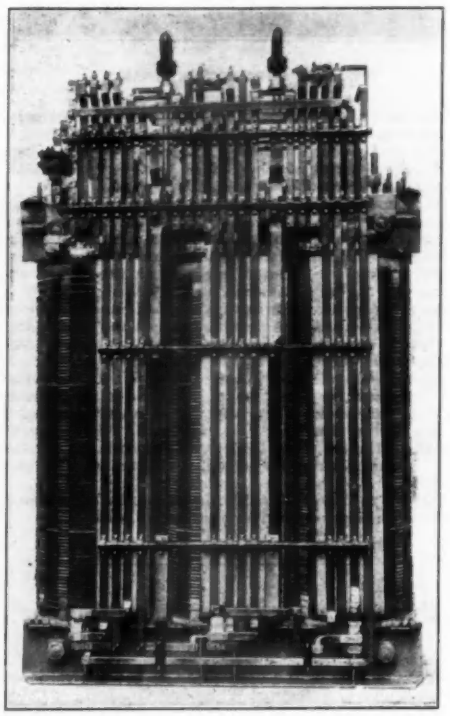


FIG. 4—5000-kVA THREE-WINDING TRANSFORMER

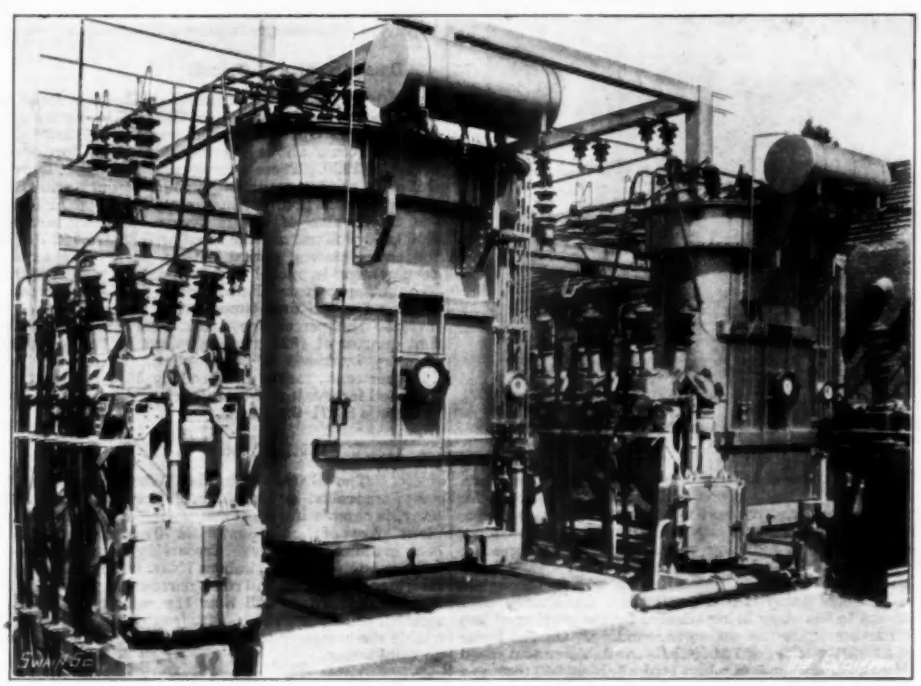
can be produced for any service and will give satisfactory operations under the most extreme conditions.

Obviously, the question of voltage regulation is very important, and it is therefore necessary to provide a large number of tappings to give voltage variation on at least two, if not three, of the windings. The design may be such that the tappings can only be changed when the transformer is not connected to the line. An example of such a transformer made by the English Electric Company is shown in Fig. 2, which illustrates a 1000-kVA, three-phase, 60-cycle unit with three separate windings for operation at 40 kV, 12 kV, and 2·4 kV, with tapping switches on each of the three windings to allow for voltage variation. The 2·4-kV load might be supplied from either the 40-kV or 12-kV system, or both systems simultaneously. Fig. 3 is of interest as showing a three-winding unit of relatively small output. Fig. 4 illustrates a 5000-kVA three-phase, 60-cycle transformer with windings for operation at 40 kV., 7·6 kV. and 2·2 kV. In this case there are tapping switches on the high-voltage winding only.

In many cases, however, particularly where the three-winding transformer a coupling together systems of large

A PAIR OF THREE-WINDING TRANSFORMERS

ENGLISH ELECTRIC COMPANY, LTD., LONDON, ENGINEERS



output, it is not possible to shut down in order to change tappings, in which case the tappings can be arranged for changing under load. Obviously, if this arrangement is applied to each of the three windings, the extra complication and consequent cost are considerable, but in many cases it is essential. In such transformers it is necessary to reduce the complication to the minimum, and the design of the on-load tap-changing gear has to be considered from this point of view. There are two schemes, known as the parallel winding scheme and the mid-point auto-transformer scheme. The former scheme involves greater complication in the windings than the latter, for the parallel winding arrangement involves four times as many tappings for the same total range and number of steps as compared with the mid-point auto-transformer arrangement, and in addition to this the latter has only one regulating winding, as compared with two in the former design. Hence, for three-winding transformers, in particular, the mid-point auto-transformer scheme of on-load tap-changing is preferable because the complication is very materially reduced.

Naturally the same argument applies to two-winding transformers when on-load tap-changing is desired.

Whilst we have dealt with three-winding transformers, there is no reason why any limit should be imposed to the number of windings. Already some very big four-winding transformers are in service with on-load tap-changing on three of the windings. Obviously, the problems of design become more difficult where the number of windings is increased, and the manufacture of such transformers demands considerable experience. Fig. 5 shows two three-winding transformers in service, the core and windings being similar to those shown in Fig. 4. All the transformers illustrated were made by the English Electric Company, Ltd.

The French Rolling Stock Industry

THE report of the Chambre Syndicale des Fabricants et Constructeurs de Materiel pour Chemins de Fer et Tramways, which was presented at the recent annual meeting, deals with the situation of the French market in 1929, the export market, the recent formation of a European cartel for coaches and wagons, and the question of the commercial concentration of French industry.

At the outset the report states that the year was characterised by a distinct change in the situation of the home market, considerable requirements replacing the comparative paucity of orders in preceding years. The hope is expressed that the decision arrived at in principle by the Superior Railway Council (Conseil Superieur des Chemins de Fer) to approve quinquennial programmes, revisable every year, will be carried into effect, since the possibility of foreseeing work for the shops and so, on the one hand, allowing the national industry to organise itself, against periods of economic depression, and, on the other, enabling it to develop foreign markets, would be of great value.

The year 1929 appears to have been the most favourable for the wagon industry since the war, and the best for the locomotive branch since the exceptional period of 1920–21. In the home market the large railway networks placed orders for 281 locomotives of 24,717 metric tons, as compared with an average of 409 of 27,678 tons in the five years 1909–1913, and an average of only 180 units of 15,953 tons in the five years 1925–29. The number of tenders ordered in 1929 was 165 of 4844 metric tons.

Concerning passenger rolling stock, the report states that 601 coaches, of a total of 24,391 metric tons, were ordered last year. The average for 1909–1913 was 979 of 17,633 metric tons, and the average in 1925–29 was 282 of 10,706 tons. In the case of wagons and luggage vans, the number ordered in 1929 was 17,145 of a total of 195,204 metric tons. These figures compare with 13,694 units on the average for the years 1909–1913, and an average of 5602 for the years 1925–29. During the first five months of the present year, orders have been given for 50 locomotives, 170 tenders, 340 coaches, and 7340 wagons.

Although slightly over a year ago the railways announced that their requirements had been largely covered, two months later the industry was surprised by the railways coming forward—last October—with a sixfold increase in their monthly orders for passenger coaches and wagons. The situation thus created placed the works in considerable difficulties, for although their productive capacity is much greater than the requirements demand, it was necessary to recruit a proportion of skilled labour, since the crisis had compelled a large number of workmen to seek employment in other industries.

COLONIAL ORDERS AND ORDERS PLACED ABROAD.

Besides the contracts allocated by the large railway networks, orders were given out last year by the Paris Metropolitan Railway, the International Sleeping Car Company, the Administration of Posts and Telegraphs, local and departmental railways, and certain mining and metallurgical companies for 33 locomotives, 635 passenger coaches and 2469 wagons, or more than twice the number on the average of the five last years for coaches and wagons, while the average for locomotives was 22 units in the five years.

The importance of the French needs last year is also illustrated by the orders placed in other countries. These comprised 68 locomotives, 230 coaches and 3207 wagons, and the figures compare with an average of 60 locomotives, 203 coaches and wagons in the five years 1925–29.

The course of the contracts placed in France by the French colonial market followed the same pace as that in the home market, except in the case of locomotives, the orders for which diminished.

EXPORT MARKETS AND THE WAGON CARTEL.

In order to remedy undue competition, owing to excess of building capacity, the report recalls the fact that discussions were initiated between the principal makers of coaches and wagons in Europe, and that they have just been brought to a conclusion by the formation of an international association of builders in Belgium, Germany, France, Italy, Czechoslovakia, Hungary, Austria, and Switzerland, while Poland and Rumania have asked to join the organisation. The object of the understanding is to distribute export orders among the participants *pro rata* to certain coefficients. The industries which momentarily, for some reason or other, are unable to take part in an offered transaction will be credited with the share which they have had to renounce until they are in a position to accept foreign orders. Thus the external market will become a regulator of the inland market, and will provide an outlet for production in case of a temporary insufficiency of the inland demand.

THE QUESTION OF COMMERCIAL CONCENTRATION.

The Chambre Syndicale states that for the stabilisation of working in the French shops, the above scheme represents a happy solution which can be usefully completed by the regular establishment of quinquennial programmes for the home market.

The conclusion of the European coach and wagon understanding is considered to have brought forward a serious argument in favour of the rationalisation of the French organisations, even at the cost of the sacrifice of autonomy. Such international understandings are very difficult to realise and maintain when the national participating industries are not themselves firmly grouped together and sufficiently disciplined.

The report, in conclusion, refers to the difficulties encountered by the French works in the matter of the supply of raw materials, the shortage of skilled labour, and the comparatively high wages as compared with the cost of living, &c., and it gives the costs of production in France per kilogramme of locomotives, tenders, and wagons constructed in 1929.

SIXTY YEARS AGO.

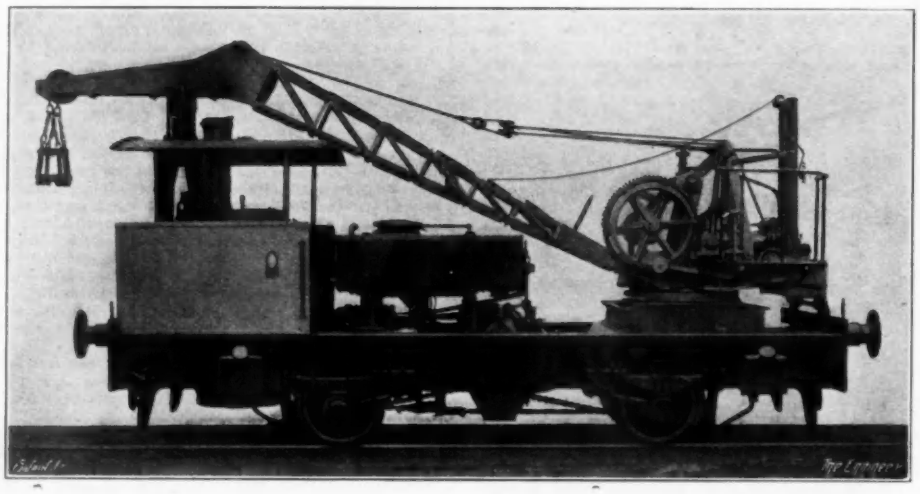
IN our own time we have had to record the outbreak of a great European war, to forecast its probable course and effect, and to discuss the part which engineers would play in it. Sixty years ago a similar task was essayed in our columns. France and Prussia had gone to war. Many thought that Russia would soon be found marching with the Germans, and it was feared that this country, too, would almost certainly become involved in hostilities. In August, 1914, our task was easier than in July, 1870, in that we knew definitely that Great Britain, Russia, and Belgium were to fight with France against Germany and Austria. On the outbreak of what was to be the Franco-Prussian War, a general alarm was felt in this country concerning the weakness of our Army. The statements made were, we admitted, only too well founded, but we reminded our readers that Great Britain looked not to her troops, but to her ships as a means of asserting her wishes or defending her rights. No nation was so well off as ours as regarded ships, guns, and sailors, and the Government was fully alive to the necessity for maintaining our naval power at its full efficiency. If we were to be involved in the war, we would not, we stated, be found as wholly unprepared for it as many people would have had us believe. The World War of 1914 was at one time spoken of as an engineers' war. So, too, in 1870, we dwelt on the part which engineers would fill in the fighting that was to be. Never since war was known, we wrote, had engineering science played so important a part in warfare as it would now. The engineer had, however, nothing with which to reproach himself. If he had given the world rifled guns, he had also bestowed on it armour plates. If he used electricity to fire the fatal mine, he also used it to warn us of the approach of the miner. If he had armed millions with the needle-gun and the breech-loader, he had also supplied the ambulance and the hospital. If he blew up bridges to prevent the escape of the retreating foe, did he not also throw up the flying path by which the foe might escape? To all these remarks we may now, as then, express assent. But what shall we say to our concluding comment? "Above and beyond all, is it not to the engineer, and to him alone, that the world is indebted for the fact that the art of slaughter is so perfect that no war can be of long duration; and that the loss of life is infinitely diminished, as compared with what it was in the days of old?" The belief embodied in these words owed its origin very probably to the rapidity with which two recent European wars—the campaigns of Prussia first against Denmark and then against Austria—had been concluded. That rapidity is to be explained by reference to causes other than efficiency in the "art of slaughter." The belief was partially disproved during the course of the Franco-Prussian War. It was prevalently held again before 1914. In light of the experiences of our own generation, is it ever likely again to be revived?

ELECTRIC POWER ON THE RAND.

EXTENSIONS to the Johannesburg Municipal Power Station, involving an expenditure of £471,620, have been considered by the Tramways Committee of the Johannesburg Council, and recommended to the Council. The extensions were recommended by Mr. A. Rodwell, General Manager of the Electricity Department, in a report in which he stated that he considered they were urgently required because of the enormous development recently in the use of electricity for industrial, business, and domestic purposes. The proposed extensions include two turbo-generator sets of 15,000 kilowatts each. It is proposed to erect the two new sets on a site adjoining the existing Jeppe-street station. Mr. Rodwell draws attention to the unexpected growth of the demand for electricity in Johannesburg. In 1925 the maximum demand was 17,700 kilowatts, with an output of 56·1 million units for the years 1924–1925. It was estimated that the power station would require to generate 67 to 70 million units during the year 1927–28, and the estimate for 1936 was 100 million units. Mr. Rodwell shows that for the year 1927–28 75·25 million units were generated, and the units generated for the year ending June 30th, 1930, will exceed 92·5 million. It is now estimated by Mr. Rodwell that the 100 million units output will be exceeded in 1931, and he considers a safe estimate of the requirements of the city for the year 1935 is 135 million units, with a maximum demand of 40,000 kilowatts. The plant at the old President-street station is obsolete with the exception of plant of a capacity of 9000 kilowatts. This 9000-kilowatt plant has been in service since 1921, and will be serviceable only for two or three years. In the event of an accident to one of the three 10,000-kilowatt units, or the auxiliaries at the new Jeppe-street station, the load would have to be met by operating obsolete plant at the old President-street station at high generation costs. Mr. Rodwell considers further that the whole of the President-street station plant should be scrapped. The two new turbo-generator sets which it is proposed to install will bring, with the 30,000-kilowatts of plant already installed at the Jeppe-street station, the capacity to 60,000 kilowatts. Thus, if one of the larger sets were out of commission, the station could supply 45,000 kilowatts.

THE Railways Administration intends to construct twenty-eight new steel bridges on the line between Bloemfontein and Blenheim, Orange Free State, with the object of bringing the capacity of the line up to main line standards. The scheme will cost some £50,000 and will include spans ranging up to 100ft. long.

LIGHT LOCOMOTIVE CRANE FOR ASH HANDLING



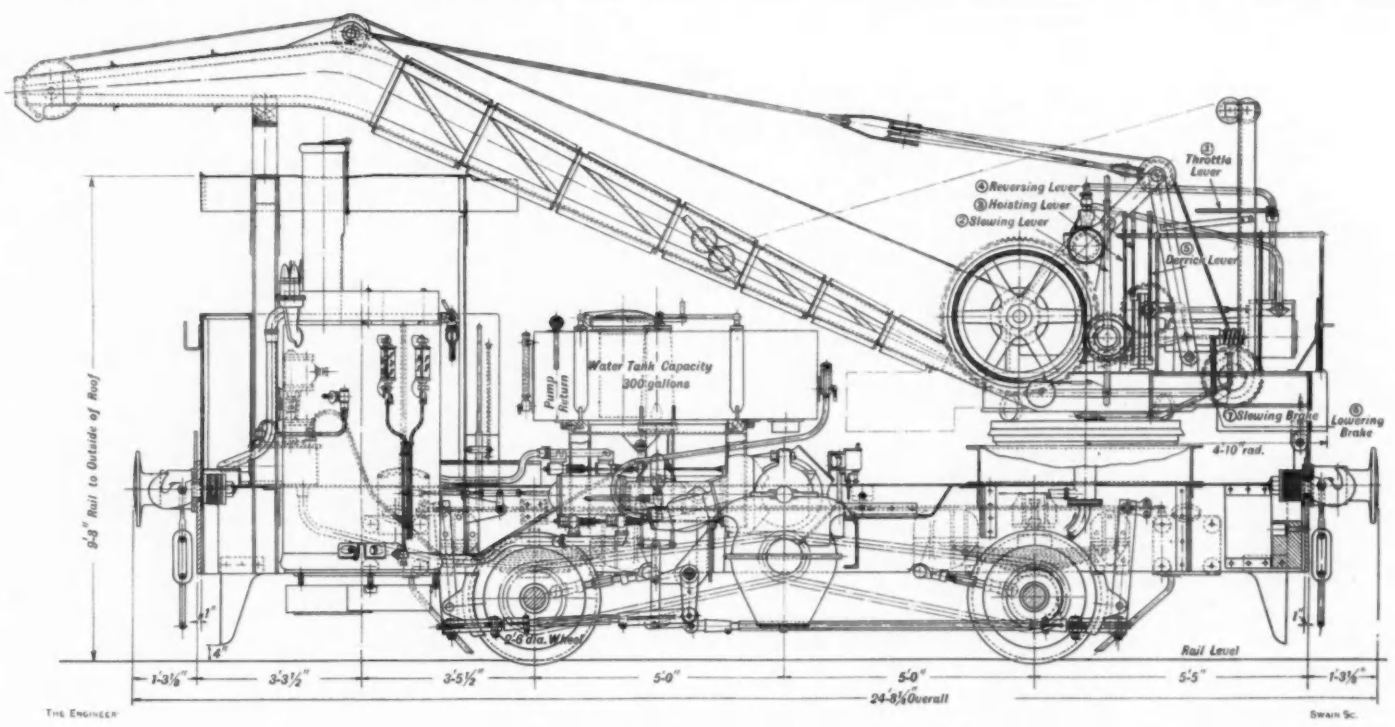
A Light Locomotive Grab Crane.

THE expeditious and economical disposal of the ashes brought into the running sheds of railways has led to many experiments being made with pits, conveyors, and so forth, but it almost seems as if the problem is not yet solved. A scheme has, however, been evolved by Mr. H. N. Gresley, chief mechanical engineer of the London and North-Eastern Railway, which promises to be satisfactory under the conditions experienced at the northern termini of that railway. He has ordered from the Sentinel Waggon Works, Ltd., of Shrewsbury, some light locomotive grab cranes, the first of which to be delivered is illustrated by our half-tone engraving and line drawing. These cranes will be employed to grab out of a trough between the siding rails the ashes raked from the ashpans of the locomotives, and to load them into railway trucks alongside.

The ashes have to be picked up by a grab and lifted to a sufficient height to load into a high-sided wagon so that the distance from rail level to the crane hook in the lifting position has to be not less than 16ft. The distance from the centre of the ashpit to the centre of the parallel road on which the crane is to work is also 16ft., which fixes the necessary radius of action at that figure. The locomotive is required to do its own shunting and placing of wagons in position and to act generally as a light shunting engine when not engaged in loading ashes; it is therefore fitted with standard railway buffing and draw gear. It is expected to serve more than one steam shed in a district, so the jib must be securely stowed down within the limits of the standard loading gauge for travelling. Reasonable running speeds under its own steam must be attainable when travelling from shed to shed so as not to interfere with ordinary traffic.

The locomotive illustrated has been built up almost entirely of the standard parts used in the maker's 100 H.P. C.E.D.G. type of shunting engine, a few small alterations being required only to the engine, as it has to be placed horizontally instead of vertically on top of the gear-box. In our issue of May 18th, 1928, we gave a comprehensive description of a Sentinel rail coach, which embodies many of the characteristics of the crane, so it is unnecessary to enlarge upon the details of the engine and boiler here. The boiler is a standard one and supplies steam both for running the locomotive and working the separate engine which operates the crane. For the latter purpose the steam passes through a reducing valve, bringing the pressure down from 275 lb. to 180 lb. per square inch.

The engine transmits power to the wheels through a gear-box containing a two-speed gear, the change over from one to the other being effected by the moving of two small levers while the engine is standing. On the lower gear a tractive effort of 12,000 lb. is available up to a speed of 1¼ m.p.h., and at 5 m.p.h. a load of about 350 tons can be hauled. On the high gear speeds up to 24 m.p.h. can be attained, hauling a load of 50 tons, and the jib can be safely secured within load gauge limits. The crane is capable of lifting a load of 30 cwt. at the full radius of 16ft., which allows of a grab holding about 12 cwt. At a smaller radius weights up to about 3 tons can be lifted, so that apart from its special purpose the crane locomotive is useful for general work. Its total weight in running order is 24 tons, which is sufficient to enable it to do its work without any holding down clamps on the rails. The crane portion was manufactured and supplied by Henry J. Coles, Ltd., of Derby.



GENERAL ARRANGEMENT OF CRANE

Canadian Engineering News.

(From our own Correspondent.)

Chemical Industry Progress.

CHEMICAL production in Canada during 1929 showed a gain of 14 per cent. over the total for the preceding year. At 168,598,892 dollars the output value of chemicals and allied products made in the Dominion reached a higher valuation than in any previous year except 1917 and 1918, when the production of munitions carried the output value to an abnormally high level. The increase in value in 1929 over 1928 was 21,623,055 dollars. In 1929 gains were recorded in twelve of the fifteen main divisions; the exceptions, each showing only a slightly lower total than in 1928, were the coal tar distillation industry, the manufacture of explosives, ammunition and fireworks, and the group specialising in the preparation of polishes and dressings. In the 549 plants classified as manufacturers of chemicals and related products the capital employed totalled 172,374,686 dollars, or 23,400,000 dollars more than the sum reported by the 572 concerns in this class in 1928. Chemical process industries are well established in Canada and contribute largely to domestic production and the export trade.

Ontario's Mineral Output.

The value of metallic production from mines and smelters in the province of Ontario during the opening quarter of 1930 showed an increase of 1,383,632 dollars, or 7 per cent. above the record for the corresponding period of 1929. There were several prominent features in Ontario's mining activities during the quarter. One was the increase in gold production at Kirkland Lake, where the total value of the recovery—including silver—was 4,063,616 dollars, as compared with 3,415,742 dollars in the corresponding period of last year. The expanding development in nickel and copper was well maintained. The new producer—Falconbridge—which reported production for the first time during the period, helped to increase the percentage gains. As compared with the first quarter of 1929, the ore raised by the nickel-copper industry increased 12·9 per cent., the ore smelted by 26·9 per cent., matte produced by 39·8 per cent., matte exported for treatment by 3·7 per cent., and matte refined in Canada by 71·9 per cent.

Treating 100ft. Timber.

The British Columbia Wood Preserving Company, controlled by Dominion Power and Chemical Company, is completing the construction of a large creosoting plant. Area of the site comprises 70 acres, of which 45 have been made ready for use. Creosoting retorts will be made large enough to treat timbers 100ft. in length. Down the interior of the retort will run a narrow-gauge railway track, upon which trucks will bear the railway sleepers to be treated. A dock with 1000ft. frontage has been built to enable the company to take full advantage of its situation on tidal water.

Lignite Coal Developments.

Important developments are taking place in the Souris lignite coalfield at Estevan, Saskatchewan. The Truax-Traer Coal Company has an army of men engaged in construction work on what, it is stated, will be a million-dollar investment for the mining and marketing of raw Souris lignite. The venture is in the nature of a gigantic stripping process. A huge electrically driven shovel will clear the over burden while another shovel will be used to scoop out the coal and empty it into dump cars to be conveyed by narrow-gauge tracks to a tippler, where the coal will be sorted and graded.

Second only in importance to this project, and closely related to it, are the plans of the Dominion Electric Power Company, which, a quarter mile from the Truax-Traer camp site, has now well under way the construction of a new 300,000-dollar modern power plant. Of interest also is the operation of the Western Dominion Collieries briquetting plant, 14 miles east of Estevan, which is now successfully past the experimental stage in the production of lignite briquettes and powdered fuel, and is soon to turn its attention to the extensive field of by-products now awaiting development. Promising possibilities are seen for the future in the utilisation of Saskatchewan lignite coal in the production of fuel, oil, tar, and many other products, as well as gas.

Big Seaboard Power Plant.

The new Seaboard power plant of the Dominion Steel and Coal Corporation, at Glace Bay, Nova Scotia,

representing an outlay of 1,000,000 dollars, has been put into operation. Situated on the shores of Glace Bay Lake, an up-to-date steam-electric plant using pulverised coal has been erected to supply electricity for electrical operation of the company's numerous coal mines throughout the district. In preparation for the beginning of operations, much work has been going on in recent months in the erection of high-tension power lines—including a high-voltage submarine line under Sydney Harbour to supply the workings at Sydney Mines—and in the changing over of machinery at the mines to meet the new conditions created for efficient operation of the company's properties. The new plant is the largest electrical station in Eastern Nova Scotia, and it has been designed in accordance with the latest practice in the production of electrical energy by steam. Practically speaking, the consumption of high-quality coal will be nil, for the plant is to operate on only waste coal and splint. The plant is to be capable of generating 55,000,000 kWh of electric energy annually with a generator installation of 10,000 horse-power.

Mine Head Electric Plant.

A modern steam-electric plant, using pulverised coal from adjacent mines, is to be established by the New Brunswick Power Commission in the vicinity of Grand Lake. The Commission has been authorised by the Government of New Brunswick to proceed immediately with the establishment of such a plant to supply power for industrial and other uses in nearby districts. The area in which the new plant will be situated is stated to have bituminous coal resources estimated at about seventy million tons.

New Source of Petrol.

The enormous deposits of tar sands in Northern Alberta may now be regarded as a potential source of light oils, much or all of which can be used as a motor fuel. That such a development is now technically feasible was shown by figures submitted by Dr. E. H. Boomer, of the University of Alberta, to the Associate Committee on Gas Research of the National Research Council. Commercial developments, it was stated, may not be far distant. Already a successful process of recovering tar from the almost inexhaustible deposits has been worked out by Dr. K. A. Clark, of the University of Alberta, and a semi-commercial plant is now being operated in the field under the joint auspices of the Research Council of Alberta and the Dominion Department of Mines.

It was research on this tar made possible by grants over a number of years of the National Research Council and the Alberta Council that has rendered Dr. Boomer's discovery possible. By the application of hydrogen, which may be obtained from the enormous quantities of natural gas that are going to waste daily in that province, Dr. Boomer hydrogenated the tar, producing a light oil which cracks readily to form petrol. Dr. Boomer reported that he had been almost entirely successful in preventing the formation of coke.

New Fertiliser Plant.

Canadian Industries, Ltd., has commenced construction of a fertiliser plant at Beloeil, Quebec, and will manufacture not only mixed fertiliser, but also superphosphate. The mixed fertiliser and superphosphate units are to be housed under one roof, which will necessitate a building 360ft. by 117ft. The phosphate rock storage building, which is a separate structure, is 80ft. by 168ft. The superphosphate will be made by a new method, which is said to be capable of producing a dry, free-flowing substance.

Work on the Beauharnois Canal.

The Beauharnois Power Corporation has now put in operation its entire excavating equipment on a 24-hour-a-day basis. This equipment, which was assembled during last winter, includes one hydraulic dredger, one 8 cubic yard electric shovel, one 4 cubic yard electric shovel, one 2 cubic yard electric shovel, seven petrol dragline shovels, four 10 cubic yard steel tower excavators, fourteen locomotives, ninety dump cars, one rock-crushing plant, and one 26,000 barrel fuel oil tank. Substantial progress was also made during the winter on the construction work itself. The battery of dragline shovels which went into operation last autumn have completed during the past ten months many miles of dyking along the route of the canal, and for the settling basins required in the dredging operations. By reason of the contours of the ground, the work requires as much embanking as excavating. The large dredger went into operation on April 15th, and its performance has been highly satisfactory. In the blasting operations at the power site 200,000 cubic yards of rock had been removed by the end of May. The rock is now being excavated by electric shovels, and removed to the crushing plant. The construction railway, which is now operating on 13 miles of track, will within a few weeks be completed to 15 miles, parallelling the entire route of the canal. This summer the pay roll will be increased from 1400 to 2000 men.

Canadian Machinery.

Canadian manufacturers are now supplying most of the important machinery used in Canadian mines, and are contributing substantially to a reduction in costs of mining operations. In view of the fact that only a few years ago much of the new machinery and equipment had to be imported, the change is eloquent testimony to the enterprise of the manufacturers, and it is also evidence of the conviction that the mining industry in the Dominion has created a consistent and growing demand. Twenty years ago the building of a 10,000 H.P. generator stood out as an accomplishment. To-day, the Beauharnois Power Company's job calls for generators of 55,000 H.P. to be built in Canada, and it is considered as a more or less ordinary piece of business, although they are among the largest hitherto built in the British Empire. A comparatively few years ago, a 30-ton steel casting was the largest produced in Canada, and there were no facilities for annealing it. To-day Canadian manufacturers can anneal castings up to 80 tons, and the importation of steel castings has fallen off to a very considerable extent.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

No Change.

THE trade position in the Midlands and Staffordshire shows no change from last week. Engineers and manufacturers find business quiet in all branches, and the demand for iron and steel from local mills is consequently but moderate. No forward contracts are being placed, orders being purely on account of current needs. The weekly meeting of the iron trade in Birmingham to-day—Thursday—was thinly attended, and apart from the interest displayed in the relative positions of prices of native and continental materials, it was a dull affair. The little business transacted was put through at last week's prices.

Raw Iron.

The consumption of pig iron by the Derbyshire pipe foundries continues at a satisfactory rate, but sales on the open market are becoming fewer than ever. Midland foundrymen are far from satisfied with the present price position, and are resuming their protests to furnacemen and pressing for further concessions. They reiterate their determination not to buy more iron at a time than is absolutely essential until prices are more in keeping with their idea of market values. At the moment the foundries have only a limited amount of business on hand, and very small parcels of iron suffice to keep them going. Forgemen are poorly employed, and only light tonnages of raw material are changing hands on account of this branch of Midland industry. It is impossible to judge the extent of stocks now being held by furnacemen in Northamptonshire and Derbyshire, but it is interesting to note that so far there has been no curtailment of output in this area. In this respect the district is much more fortunate than the North-East Coast and South Wales, in each of which a number of furnaces have been blown out. Pig iron consumers are closely watching the development of the continental situation in the hope that a lower range of prices will give them a lever to use against their local suppliers. At date foreign raw iron prices are indeterminate, but should they ultimately prove to afford any advantage to local consumers there is every probability that foundrymen will embrace the opportunity, more as a means of forcing the Pig Iron Producers' Association to lower its charges than from any desire to utilise foreign iron. There is no increase in activity in the raw iron trade on the week, and prices are maintained at the Association level. It should perhaps be pointed out, however, that when the Central Pig Iron Producers' Association reduced prices recently, it was intimated that the new rates were limited to the Midland zone. Prices in the London area had already been lowered by 2s. 6d. in reply to competition from other districts. It is now stated that a further reduction of 2s. 6d. has been made for the London area. A further announcement of interest is that Leicestershire consumers are to get their Derbyshire pig at zone rates, instead of being called upon to pay the additional carriage from extreme points.

Manufactured Iron.

Ironmasters in Staffordshire are experiencing considerable difficulty in keeping their plants in operation. A number of fortunate firms engaged in the production of best grade bars are moderately well placed for orders and are able to continue regular rolling, but the bulk of the wrought iron trade is very poorly employed on orders coming in from day to day. The struggle becomes worse each week, and the demand for Staffordshire Crown and common bars shows a persistent decline. It is impossible with present production costs, makers assert, to lower selling rates, but even were they prepared to do so there is no evidence that it would stimulate demand. Though it is admitted that makers from other districts are securing Crown bar business because of their lower prices, Staffordshire ironmasters are of opinion that the sum total of the orders in circulation is so small that their competitors cannot be doing very well. Local makers' quotations for Crown iron range from £10 to £10 7s. 6d. per ton and for nut and bolt and fencing bars from £9 to £9 5s. per ton. Continental No. 3 iron, extensively used in the Black Country nut and bolt works in place of nut and bolt bars of native production, is still reaching the district in considerable quantities. Purchases are being made on very favourable terms, merchants keenly competing for the business. A figure well under £6 per ton is said to be acceptable at date for Belgian No. 3 iron. Wrought iron strip is being steadily purchased by Midland tube works which are paying £11 2s. 6d. per ton delivered for their supplies.

Steel.

Midland steel works are badly in need of orders, and some of them are only able to carry on by working short time. Demand remains as in recent weeks on a strictly restricted scale in all departments, consumers only buying for current needs. Consumption shows no sign of increasing and engineering firms generally in this area do not speak encouragingly of the outlook. The next couple of months, they are forced to believe, will yield but poor results, and little betterment of the situation is anticipated before the autumn. Prices of finished steels are unchanged, angles commanding £8 7s. 6d., joists £8 10s., tees £9 7s. 6d., and ship, bridge, and tank plates £8 17s. 6d.—all subject to rebate. In the half-products branch the position is little better. The unsettled conditions ruling on the Continent have affected the market here and consumers are awaiting the clearing of the situation before placing orders. Though the control of the cartel over semis is said to be still in force, consumers here are not at all certain that foreign prices have reached their lowest level. Native material is selling slowly, and there has been no further fall in values during the past week. Small steel bars make about £7 17s. 6d. to £7 18s. 6d., and mild steel billets £5 18s. 6d. upwards. Staffordshire hoops continue to be quoted £10 per ton at makers' works.

Galvanised Sheets.

Makers of galvanised sheets in this area, though better placed than of late, report that the overseas markets have again lapsed into a quiet state, and demand is on a low scale. Many recent inquiries have not yet resulted in firm orders, but hopes are entertained that additional business will be secured before long. Last month's trading shows the state of affairs in the industry. Exports of sheets totalled only 32,624 tons, being the smallest shipment in any month this year, and, indeed, the lowest recorded for several years. Rollers of 24 gauge corrugated sheets maintain their selling figure at £11 17s. 6d., efforts to raise the price level recently made by some sellers not having been generally adopted. It is hardly considered time for such a movement. Black sheets sell fairly freely at recent rates. Demand even in this department of the market is not, however, as good as might be expected. Motor engineers are not calling for the same tonnage as is usual at this period of the year.

Scrap.

The demand for steel scrap has been further reduced and very little business is being done by Midland merchants. The closing of the South Wales steel works and the fairly large supplies still held by consuming works leaves a very limited field for sellers. Offers of supplies at low rates are reported to have been made without result, consequently, generally speaking, quotations are unchanged. They do not, however, represent the current market value, which it is almost impossible to determine.

Birmingham's New Reservoir.

Having cost approximately half a million pounds and taken five years to construct, the new Corporation reservoir at Bartley Green was opened by the Lord Mayor of Birmingham (Alderman M. L. Lancaster) and Alderman E. Martineau (Chairman of the Water Committee) on Saturday last. The effective capacity of the reservoir is just over 500,000,000 gallons, constituting an expanse of water two-thirds of a mile long, 630 yards wide at its maximum section, and 114 acres in area. The new reservoir, when it is full, will ensure a reserve supply of water for the city for fourteen days, whereas previously the reserve would have lasted only four days. It has been constructed in the valley adjacent to the Frankley works by means of an embankment near the village of Bartley Green. All trees and hedges were cleared, and all soil and vegetable matter removed from the site, and the whole area of the basin was covered with stone ballast or concrete to preserve the purity of the water and to prevent erosion of the underlying marl by wave action.

Unemployment.

Unemployment in the Midlands area continues to expand, the total of 288,815 being an advance on the week of no less than 4580. In the Birmingham area the total of 48,982 is 2303 more than a week ago and 25,601 in advance of the number unemployed at the corresponding period last year. At Coventry a further slight increase this week has brought the total up to 12,017, which is approximately 7370 higher than the figure ruling at this time last year. Leicester now has 13,647 unemployed. Nottingham 11,153, and Stoke-on-Trent 28,888, all of which are in advance of last week's figures. There has been a small and welcome decline at Wolverhampton on the week, the figures having fallen from 11,235 to 10,992.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

£500,000 Sewerage Scheme.

WYTHENSHAWE, which lies to the south of Manchester on the Cheshire border, and which in April of next year will legally become incorporated within the city area, is very much in Manchester's public eye at the present time, for it is proposed to push forward with a large housing scheme to meet the demand for accommodation. It is not proposed, however, to wait until next April before proceeding with the developments that have been planned, and within the last few days the Rivers Committee of Manchester Corporation has considered schemes for building the main sewers in the area. The cost of these sewers will not be far short of £500,000, and the Corporation Finance Committee is to go into the matter at a meeting this week. The proposal is to proceed with the work of constructing the sewerage system at an early date, and in order to cover the estimated expenditure which will be incurred during the current financial year approval is sought of a special estimate of £120,000. There will be a full debate on the matter at the forthcoming meeting of the City Council, when a report of Mr. J. B. L. Meek, the City Engineer, will come up for approval.

Order for Steel Rails.

At a meeting of the Manchester Transport Committee on Tuesday last, July 22nd, it was decided to place an order for 2000 tons of steel tramway rails with the Cargo Fleet Iron Company, Ltd., Middlesbrough.

Too Much Capital.

Vice-Chancellor Sir Courthope Wilson, K.C., in the Manchester Chancery Court on Monday, granted an application by Thomas Mitchell and Sons, Ltd., iron and steel merchants, of Bolton, for confirmation of a reduction of capital from £30,000 to £21,000. The issued and fully paid capital of the company is composed of 600

shares of £50 each. It is proposed to return £15 per share, which represents capital in excess of requirements, to the shareholders, and then to divide the remaining £21,000 into shares of £1 each.

Dividends Maintained.

The directors of Mather and Platt, Ltd., textile and general engineers, of Newton Heath, Manchester, have declared a dividend on the preference shares for the half-year ending June 30th at the rate of 5 per cent. per annum, less income tax, and an interim dividend on the ordinary shares of 5 per cent. (actual) free of tax. The dividends are the same as in the last financial year. The previous year's distribution on the ordinary shares has also been maintained in the case of Foden's, Ltd., steam wagon makers, of Sandbach, the directors having declared a dividend of 3 per cent. for the twelve months to the end of June. In 1927–28, however, the ordinary shareholders received 6 per cent., and in 1926–27 7½ per cent. was paid.

Another Pit to Close.

Mining operations at another Lancashire colliery are to cease, the directors of the Garswood Hall Colliery Company, Ltd., having decided to close down their No. 2 pit at Long Lane, Ashton-in-Makerfield, near Wigan. There is a possibility, however, that later in the year, when the winter demand develops, the pit will be re-opened. In the meantime, efforts will be made to absorb, at other collieries owned by the company, some of the 700 workers who will be affected.

Non-ferrous Metals.

On the whole, there has been a slight improvement in conditions on the non-ferrous metals market during the past week, copper alone having failed to register higher values on balance. In the case of this metal, it is becoming increasingly obvious that recent reductions in prices by United States producers have served to sharpen the appetite of consumers for more, and this they are getting for refined descriptions, and standard brands are all lower on the week. Buying for industrial consumption is restricted to early requirements, and until the statistical position is very much different from what it is, a departure from this policy is extremely unlikely. From the point of view of producers of the metal, the tin market, since my last report, has borne a somewhat healthier tone, and, virtually, the whole of the loss of the two previous weeks has been wiped out. There has been no real improvement at the consuming end, but rather more business in tin has been transacted, possibly in the belief that values have touched bottom and that an effective policy of output curtailment at the mines would be immediately succeeded by a rise in prices. The demand for lead has been fairly good, and as supplies seem to be carefully regulated, the market has maintained its firmness, an advance of 5s. per ton compared with a week ago having been registered up to the time of writing. Spelter has come in for rather more attention than of late, and a further recovery in prices, this time to the extent of about 15s. per ton, has to be recorded.

Iron and Steel.

A disappointing absence of any sign of returning animation is an unmistakable feature of the iron and steel markets in this area. The foundries are taking only relatively small quantities of pig iron, and very little forward buying of any consequence is going on. Prices keep up at 74s. 6d. per ton, delivered equal to Manchester, for Staffordshire and Derbyshire brands; about 94s. for Scotch, and 89s. for West Coast hematite iron. Finished iron, also, is in quiet demand, with Lancashire Crown bars at £10 5s. per ton and No. 2 at about £8 15s. New buying in the case of steel is restricted, and only in a few sections can delivery specifications be regarded as even reasonably satisfactory. The demand from locomotive engineers at the moment is moderate, but rollers are not without hope of improvement here. Signs of improvement, however, in the case of constructional engineering firms in Lancashire are lacking, and only here and there are works fully occupied. In this and in most other directions, buying interest in steel is restricted. This also applies to imported materials, notwithstanding the heavy cuts that have been made in prices asked on this market during the past week or two. Continental joists are quoted for delivery equal to Manchester at about £5 15s. per ton, angles at £5 12s. 6d., wire rods at £6 12s., steel bars at about £5 12s. 6d., Siemens plates at £7 10s., semi-finished materials at from £5 2s. 6d. to £5 5s. for billets and sheet bars, and Belgian No. 3 bar iron at about £5 12s. 6d. per ton.

BARROW-IN-FURNESS.

Hematite.

The quietness in the hematite pig iron market is more marked than ever, and there is a tendency for stocks to increase at practically every works. This increase in stocks points to one move only, and that is the restriction of output. It is no use manufacturing iron to put into stock these days, and there will have to be a damping down or blowing out in the early future unless there is a change for the better. At present, there is not a single sign of trade improving, and the position is rendered all the worse by the general quietness in the steel trade. The continental trade is quiet. There have been some dispatches, but the tonnage is on the light side. There has been a delivery to Italy recently. The iron ore trade is naturally affected and the outlook for both native and foreign sorts is dull. In the steel trade there is a distinct quietness and the Barrow mills, which, up to the week-end, were engaged on rails, have stopped, and at the moment it is not known when they will restart. At Workington, the mills are engaged at present on South American and South African contracts, but they are nearly completed. Fresh orders are very difficult to secure and competition for them is so keen as practically to cut out the margin of profit.

SHEFFIELD.

(From our own Correspondent.)

Thirty Furnaces Out of Eighty Working.

To show the present condition of the open-hearth steel trade of this district, it is only necessary to say that the number of furnaces in operation is rather more than thirty, out of a total of eighty available. The pig iron trade of the country as a whole is no better situated, for, while the number of furnaces in blast a year ago was 170, the total to-day is only 141, and there is a likelihood of several more being closed. The two furnaces of the North Lincolnshire Iron Company, Ltd., have now been closed, and it is probable that the stoppage will be an extended one, the workmen and some of the staff having been suspended or discharged.

Back to 1920.

For a comparison with the present state of things in Sheffield, one would probably have to go back ten years to the severe slump of 1920—in fact, there are some authorities who declare that things are worse now than they were then. Alike in heavy and light steel, and in most of the finished products, there is a scarcity of orders which is more pronounced and more widespread than Sheffield has known for many years. Some of the heavy branches are accepting work at prices which yield no remuneration. There is only a very moderate amount of railway work on hand, while orders from the shipbuilders are at a low level. The shortage in the latter case has been accentuated by the decline in exports and imports which is adversely affecting the shipping industry, and, as a consequence, shipbuilding. In all branches consumers, whether at home or abroad, are restricting their purchases to the minimum, for immediate needs only. While the special departments of the steel trade are booking more business, in proportion to capacity, than the heavy side, their position compares very unfavourably with that of a year ago.

Government Orders.

A few Government orders for local firms have been announced during the past week, and they will be very welcome. The Admiralty are purchasing steel sheets from the Park Gate Iron and Steel Company, Ltd.; the War Office are taking round steel from the same firm, and also from the English Steel Corporation, Ltd., and Steel, Peech and Tozer, Ltd., as well as carbon steel from W. Jessop and Sons, Ltd.; the Crown Agents for the Colonies have given orders to Craven's Railway Carriage and Wagon Company, Ltd., for carriages, to Brown, Bayley's Steel Works, Ltd., for tires, and to Guest and Chrimes, Ltd., of Rotherham, for waterworks materials; A. Grindrod and Co., have received a contract from H.M. Office of Works for heating apparatus.

Cutlery Exports.

The value of the cutlery exported in June showed an increase over May, being £71,742, as compared with £66,803, but it was practically at the same level as that of June last year, which was £71,443, and much below that of June, 1928, for which month the figure was £93,494. There was an increase in the export of safety razors, but a fall in blades. The purchases of Australia and New Zealand showed an advance, but in other markets there were declines. The total exports for the half year reach a value of £431,775, which is a drop of about £80,000 on last year. The value of the safety blades sent out of the country during the first half of this year reached the record figure of £116,268. In the scissors department exports are nearly holding their own. There is nothing fresh to say about the cutlery and plate trades, which remain in the unsatisfactory position reported in recent weeks. The Air Ministry have placed an order for electro-plated table forks with Walker and Hall, Ltd.

Doncaster and Haweswater.

One of the largest water schemes on hand in the country at present is that of the Manchester Corporation, which already draws a large part of its water supply from Thirlmere, for converting Haweswater, another of the English Lakes, into a reservoir. The work is expected to cost £10,000,000, and to take ten years to complete. A large dam is to be erected across the foot of the valley in order to raise the level of the water. The François Cementation Company, Ltd., of Doncaster, has secured the contract for part of the scheme. The work in which it is interested includes the extension of the northern section of the Haweswater aqueduct, the construction of a conduit and 5 miles of tunnelling, and the laying of pipes. Although the price of the contract is not officially stated, it is understood to be about £500,000. Four or five years, it is expected, will be occupied in the work.

Important Railway Widening.

The London and North-Eastern Railway Company is to start almost at once on its important scheme of main line widening between York and Northallerton. The work, which will be carried out with Government assistance, will occupy three years, and will involve an expenditure of about £1,000,000. The object is to give four lines, wherever possible, in order to assist the faster working of trains and to enable more goods trains to be dealt with. There are already four lines on some parts of the railway, but in others there are only two and in some three, and new lines are to be laid on three sections, having a total length of about 11¼ miles. It will be necessary to re-model three stations. Another railway item of interest relates to the London, Midland and Scottish Company, which has just placed several orders for new tonnage. These include three cargo steamers for the Goole–Continent route, which are to be built by Cammell Laird and Co., Ltd., at Birkenhead.

Nottingham as a Port.

Although Nottingham is a long way inland, it has the advantage of being on the river Trent, and it continues to take active measures for making use of that river to develop its water-borne trade. The river, the navigation of which has recently been much improved, gives Nottingham excellent communication with Hull. The Lord Mayor of Nottingham was at Hull last week, and he spoke of the developments carried out by the Nottingham Corporation in conjunction with the Trent Navigation Company, Ltd., which, he said, must increase the transport between the two cities. He announced that the Corporation of Nottingham was incurring a large expenditure in providing terminal accommodation. The latest improvement in this direction concerned the construction of a warehouse with four floors, 170ft. long by 50ft. wide, giving a total area space of 34,000 square feet. These terminal facilities, he said, would be under the management of the Trent Navigation Company, which was building motor barges of large capacity to run between Hull and Nottingham. Normally, the journey would take two or three days, but it was possible to complete it in twenty-four hours. The Lord Mayor summed up the situation by saying that the present conditions of communication made the Trent a highly efficient waterway, connecting the Humber with Nottingham, on which there was a continually increasing traffic and a service comparable in regularity and speed with that of the railways.

Removing a Level Crossing.

A conference has taken place at York between officials of the L.N.E.R. Company and a deputation from the Goole Council, with regard to the scheme for abolishing the railway level crossing in Boothferry-road, the main street of Goole. On behalf of the Council, Sir E. Owen Williams, has prepared a scheme which proposes to divert Boothferry-road near the crossing, and then by a horse-shoe shaped loop, to take the roadway over the line. It was stated at the conference that the railway company had no objection, in principle, to the carrying out of the loop road and bridge. The scheme, if carried out, will mean the demolition of four shops in the main street, twelve small houses in a side street, and temporary buildings on railway land. It has the support of the Ministry of Transport, which has promised a 75 per cent. grant towards the cost, and also of the West Riding County Council.

Colliery Safety Inventions.

Two inventions whose object is to increase the safe working of collieries are at present attracting the attention of local engineers. One of them which has been devised by Mr. J. Cook, of New Kimberworth, Rotherham, is for preventing tubs from running away in the event of a breakage of the haulage rope. This was tested in the presence of a number of officials of the Sheffield Coal Company, Ltd., at their Birley East pit on Saturday last. When the rope was "snatched" off about six unloaded tubs, the device prevented them from running back down a gradient of 1 in 7. The other device is the work of Mr. Norman Oakley, of Conisborough, and is for cage arrestation for colliery shafts or ordinary lifts. It is stated to be simple, automatic, and inexpensive. Once the suspension is broken, the cage is gradually braked, and after a breakage, repairs can be made and working resumed.

NORTH OF ENGLAND.

(From our own Correspondent.)

Large Iron Order for Teesside.

In the midst of so much that is discouraging in northern industrial circles at the moment, consequent upon the general depression which set in a few months ago, a large order secured by Cochrane and Co., Ltd., of Ormesby Ironworks, Middlesbrough, comes as a real tonic to the somewhat crestfallen spirits of both employers and workers. The depression in the iron and steel trade in the North is very severe, and the economic difficulties are deeply seated. In fact, there is less than 50 per cent. of the iron and steel-producing plant on the North-East Coast laid idle. This new work will give a ray of hope to the workmen, who were, unfortunately, looking forward to probably the worst winter they have ever experienced from an employment point of view. The contract is for 35,000 tons of cast iron segments for the Underground Railways of London, and follows upon the big tube extension scheme to be carried out. The segments will be delivered to sites on the 7½ miles track from Finsbury Park to Cockfosters, which will open up a new area for housing development, and provide additional travelling facilities in the North and North-East of London. Not only Cochrane's works, but the Cargo Fleet Iron Company, Ltd., another of the associated companies in the Furness group, will also benefit, as it may be necessary immediately to recondition a blast-furnace which was only blown out on Friday last. The contract may also necessitate the re-opening of the company's Wingate Colliery in County Durham, which was closed down recently owing to the economic situation. Altogether, 5000 men will be re-absorbed into industry as a direct result of the contract.

Cleveland Iron Trade.

The position of the Cleveland pig iron trade continues to be very dull. Buyers are very backward and are markedly disinclined to pay recognised ruling rates for the small parcels they have to purchase for early needs, but producers are pronounced in their reluctance to yield to persistent pressure for price concessions. Business is almost confined to transactions in small lots for home use. Very few export inquiries are circulating. Stocks of pig iron are still increasing a little, which is a disquieting feature. Indian iron is now being offered freely in this area at low rates, but, as it is not particularly suitable for the light castings made in this district, sales of moment are unlikely. Merchants possess very little Cleveland iron, and ironmasters adhere to the following fixed quotations:—No. 1 foundry, 70s.; No. 3 G.M.B., 67s. 6d.; No. 4 foundry, 66s. 6d., and No. 4 forge, 66s.

Hematite Pig Iron.

Makers of East Coast hematite pig iron report their heavy stocks largely sold, and if customers shortly take out their supplies against running contracts, the statistical state of this branch will be quickly strengthened. Meanwhile, producers are inclined to take a rather firmer stand and are less persistent than of late to sell iron at the unremunerative prices obtainable. Ordinary qualities of East Coast hematite are 71s. and No. 1 is put at 71s. 6d.

Ironmaking Materials.

There is but little doing in the foreign ore trade, the nominal price of best Rubio remaining at 20s. c.i.f. Tees. Blast-furnace coke is plentiful and prompt parcels are offered at unremunerative figures, but sellers will not enter into forward contracts on unprofitable terms. Good average qualities are quoted at 16s. 6d. for early delivery to North-East Coast works.

Manufactured Iron and Steel.

The outlook in the manufactured iron and steel trade is regarded as a little brighter, though business develops very slowly. A good deal of railway material is being taken up, and customers for constructional steel are accepting fair quantities. A few inquiries for sheets are reported.

The Coal Trade.

The prospects in the northern coal trade to the end of July are not bright, but the outlook is certainly no worse than in recent times. Orders on hand are rather of small volume, but contractors are confident of clearing their month's commitments, and are holding fully steady to the recent prices, which are just odd coppers below the direct sellers' quotations. There is rather more tonnage about, which is helping shippers, and the late curtailment of output appears to have reduced supplies to actual requirements. Still, producers of every class of coal are keenly on the look-out for orders, which come along very slowly. Idle days are likely to continue at many of the collieries. Only the few are able to work five days a week. The first signs of a better demand will come when the autumn days cause an enlarged consumption, but no one can say when the general trade will take a turn for the better, as there are full supplies everywhere, and buyers are showing little interest in the market. Best Northumberland steams are quoted at 13s. 6d. and smalls at 10s. There is a little better tendency in the Durham coal section. Gas coal is quoted more steadily, best qualities holding for 15s. 3d. The demand, however, remains small in volume, and the steadier appearance of the market is attributed to the reduction in output. Coking unscreened is moving steadily at 12s. 9d. to 13s., and at the latter figure any good grade is obtainable. Durham bunker coal is a quiet trade, and good qualities are available at 12s. 6d. to 12s. 9d. Gas coke is quiet, but steady, since, although stocks are slowly increasing, there is every indication of a brisk winter demand, and makers do not mind the present stocking conditions. Up to 21s. 6d. is asked for any delivery up to the end of December. Patent oven coke is unchanged, and offered at 17s. for prompt and 17s. 6d. for September.

SCOTLAND.

(From our own Correspondent.)

Steel and Iron.

THE steel and iron works are closed for the annual "Fair" holidays, which in most cases will extend this year until August 4th, owing to the weak state of the demand. There may be some improvement in the supply of specifications in the late autumn, but in the meantime inquiries tend to diminish and great difficulty is experienced in maintaining even a modest degree of employment, a considerable portion of the various plants having been idle for some time. Reports from the Continent regarding the abandonment of the steel cartel price arrangements cause some concern, as some extremely low prices are now anticipated, when £4 15s. per ton f.o.b. Antwerp has already been quoted for steel bars. Local producers cannot hope to compete against such figures in the open market. Bar iron and re-rolled steel bars have been feeling the pinch for a long time past, and the position is not likely to be improved. Small tubes are not doing very much at present, large pipes representing the bulk of the restricted turnover. Light black sheets are comparatively well placed, but heavy varieties are stagnant, as are all descriptions of galvanised sheets. Several pig iron furnaces have been put out of blast, and these are not likely to be restarted after the holidays. The prices obtained are not remunerative, and competition is keen, fair quantities being still sent to this district from England, the Continent, and India. The average net selling price of pig iron during April, May, and June, of this year, was £3 17s. 3d. per ton, and as a consequence the wages of the workmen will be reduced by 1 per cent. on basis rates.

Coal.

The miners in Lanarkshire and Fifeshire are on holiday this week. So far as round coal is concerned, supplies are ample, and only in the case of some sizes of washed materials is there likely to be any shortage. Large fuels generally are easy in price, and smalls are only upheld through lack of supplies. Aggregate shipments amounted to 231,319 tons, against 226,345 tons in the preceding week, and 168,837 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

The Coal Trade.

CURRENT market conditions so far as steam coals are concerned have not altered during the past week, and few can be sufficiently optimistic enough to look for any improvement for another month or so, although better conditions may come later. July and August are usually rather dull months, and certainly shipments this month have so far been very unsatisfactory in comparison with those for the corresponding period of last year, while, of course, August shipments will be affected by the holidays. Restricted as production is at the present time, coalowners have very great difficulty in finding an outlet for their coals, except in the case of perhaps a few special qualities. The loading position at the end of last week showed that there were as many as forty-eight idle tipping appliances at the various docks and only three steamers were waiting to berth. The situation at the beginning of this week was not a great deal better, as arrivals of tonnage over the week-end only resulted in the number of idle appliances being reduced to forty, while four steamers were waiting to get into berths. The daily inquiry for coals for prompt loading is very meagre. Foreign consumers do not appear to be at all eager to purchase, which is not surprising, as it is well known that stocks abroad are still very considerable, though in the case of coaling stations they have been kept down to the lowest limits, in view of the fact that so much tonnage has been laid up, resulting in a diminished demand for bunker coals. So far as contract inquiries for coals are concerned, the only notable addition is one from the French Marine. Prices have been asked for about 70,000 tons of steam coals or patent fuel for delivery at various bases by February 1st next. South Wales firms will be in competition with continental producers for this business, and doubtless the competition will be very keen.

Trade Returns.

Statistics issued by the Great Western Railway Company regarding the sea-borne traffic at the six docks in this district under its control are by no means satisfactory for the four weeks ended July 6th, as imports and exports came to only 2,148,989 tons, which compared with 2,401,468 tons for the preceding month and with 2,632,885 tons for the corresponding period of last year. The export of coal and coke showed a material falling off, as the total for the four weeks was 1,924,810 tons, as against 2,134,372 tons for the preceding month. Taking the whole of the trade for this year to July 6th, practically six months, it is noticed that there is a loss of round about half a million tons, inasmuch as the aggregate is 19,020,662 tons, which compares with 19,506,408 tons for the corresponding period of last year. This falling off is due to the shrinkage in the export section, for which the figures for the first half of this year are 16,419,480 tons, as against 16,977,798 tons.

Raglan Collieries Reopened.

After a stoppage lasting nearly three months, work was resumed last week at the Raglan collieries, but it will be some time before full operation is reached. The South Wales Miners' Federation has not come out of this dispute at all well. The men have returned to work on exactly the same conditions on which they came out. It was on April 23rd that forty of the men stopped work after serving fourteen days' notice, and then the Federation called out the remainder of the men. It is estimated that the strike has cost the Federation about £700 a week, while the men have sacrificed in wages an average of about 55s. to 60s. per week.

Tin-plate Wages.

The ascertainment for the three months ending June 30th, which will govern the wages in the Welsh tin-plate trade for the three months commencing August 3rd, shows a percentage on the scale of 7 per cent., as compared with 4·375 per cent. for the previous quarter, an increase of 2·625 per cent. The percentage gain in favour of the workers is equal to about 6d. in the pound, making 1s. 4d. in the pound on the last two ascertainments. Lower-grade workers are in receipt of an *ex gratia* bonus of 7½ per cent. The question whether this will be continued will come up for discussion by the employers this week.

Dry Dock Property.

At the end of last week the dry docks and plant belonging to Hills' Dry Docks and Engineering Company, Ltd., of Cardiff, in voluntary liquidation, was put up for auction, but no sale was effected, the property being withdrawn. It was stated by the auctioneer that if there was a buyer for the dry docks as a going concern, he hoped that steps would be taken at once to negotiate, as if the properties were not disposed of by the end of July, his instructions were that the plant, machinery, &c., would be sold piecemeal, with the result that the dry docks would have to be closed down and scrapped. Hills' undertaking is one of the oldest on this channel, its history going back more than seventy years.

Current Business.

The tone of the steam coal market continues to be very quiet for early shipment. Collieries are still working irregularly, but even so there is not sufficient demand to absorb production. Large coals are especially plentiful, and these grades as well as smalls are obtainable on the basis of minimum prices. The only comparative firmness in the market is in respect of sized coals of dry quality, which meet with a fairly ready demand. Coke and patent fuel remain featureless sections, while pitwood is also quieter at round about 27s. 3d.

CATALOGUES.

WIRE BRUSHES, Ltd., Roberttown, Liversedge.—An illustrated list of all types of wire brushes.

HANS RENOLD, Ltd., Didsbury, Manchester.—A booklet giving details of a new chain clutch.

PLENTY-STILL OIL ENGINES, Ltd., Newbury.—A list of the "Newbury" range of stationary type crude oil engines from 5 to 22 B.H.P.

J. COLLIS AND SONS, Ltd., 43, Regent-square, W.C. 1.—List No. 49 of the new lightweight platform truck.

BULL MOTORS, Ltd., Ipswich.—A publication on "Eddy Current Brakes" for trackless trolley vehicles.

THOMAS ROBINSON AND SON, Ltd., Railway Works, Rochdale.—Folder on planing and moulding machines.

EDGAR ALLEN AND CO., Ltd., Imperial Steel Works, Sheffield.—A descriptive brochure on rotary kilns and coolers.

LEHMANN, ARCHER AND CO., Ltd., 5, Farringdon-road, E.C. 4.—An illustrated price list of ground thread precision taps.

D.P. BATTERY COMPANY, Ltd., Bakewell, Derbyshire.—A booklet on "Kathanode" traction cells for electric vehicles.

STURTEVANT ENGINEERING COMPANY, Ltd., 147, Queen Victoria-street, E.C. 4.—Publication No. 1068 on propeller fans.

B. B. FENN, Ltd., "Fenbo House," Great Chapel-street, W.1.—A leaflet on "Fenbo" glareless crystal ultra-vi-ray domestic electric lamps.

A. REYROLLE AND CO., Ltd., Hebburn-on-Tyne.—Pamphlet No. 808 describing a metal-clad draw-out pillar-type switchgear for mining and industrial conditions.

ALLEY AND MACLELLAN, Ltd., Sentinel Valve Works, Worcester.—Catalogue W. 3 of "Sentinel" valves and accessories for generating stations and power plants.

JOHN I. THORNYCROFT AND CO., Ltd., Thornycroft House, Smith-square, S.W. 1.—A 40-page book giving a pictorial review of the firm's activities, together with a range of its manufactures.

WOODALL-DUCKHAM VERTICAL RETORT AND OVEN CONSTRUCTION COMPANY (1920), Ltd., Allington House, Victoria-street, S.W. 1.—A brochure illustrating a number of "Becker" coke ovens installed by the company.

ENGLISH ELECTRIC COMPANY, Ltd., Queen's House, Kingsway, W.C. 2.—The following publications:—No. M 21: "Arc Welding at a Large Boiler Works." No. K 90: "Power Factor Correction, Systems and Economic Results." No. M 24: "The Alouette Hydro-electric Generating Station," which is a reprint from our issue of April 19th, 1929.

CONTRACTS.

WILLIAM BOBY AND CO., Ltd., have been awarded a contract for one of their "Azed" base exchange water softeners by the Miners' Welfare Committee for use at the Harton Pithead Baths, South Shields.

THE CLEAN COAL COMPANY, Ltd., has received an order from the Tinsley Park Colliery Company, Ltd., of Sheffield, for a plant to treat coking coal by the de-dusting process. This plant will be capable of dealing with the whole requirements of the colliery's by-product coke ovens.

INTERNATIONAL COMBUSTION, Ltd., Kingsway, London, has been awarded the contract by the North Metropolitan Power Station Company, Ltd., for additional boiler plant at Brimsdown. The new plant will comprise four combustion steam generators of 175,000 lb. to 200,000 lb. per hour evaporation at 325 lb. pressure and 780 deg. Fah. final temperature, each boiler being unit fired by Raymond-Lopulco mills.

DORMAN, LONG AND CO., Ltd., of Middlesbrough and London, have secured the contract for the strengthening of the Scotswood Bridge over the Tyne, about 3 miles upstream from Newcastle, subject to the approval of the Ministries of Health and Transport. This bridge, owned by the Newcastle-upon-Tyne Corporation, is a suspension bridge carrying a roadway and footway, and the strengthening work will take approximately 36 weeks and will require 350 tons of steel. The contract price is £30,343 12s. 10d.

IT is officially announced by the Great Western Railway that the following, among other, contracts have recently been placed:—Supply and erection of two movable coal hoists and traversers at Queen Alexandra Dock, Cardiff: Hydraulic Engineering Company, Ltd., Chester; supply, delivery and erection of overhead contact line at Queen Alexandra Dock, Cardiff: Callender's Cable Construction Company, Ltd., London; supply, delivery and erection of one movable coal hoist and traversers at North Dock, Newport: Vickers-Armstrong, Ltd., London; foundations of carriage shed, Cardiff (concrete): Christiani and Neilsen, London; reconstruction of embankment road bridge and widening of adjacent bridge at Lairs, Plymouth: Caffen and Co., Ltd., London; supply and erection of chain-grate stokers for Stirling boilers, Swindon: Edward Bennis and Co., Ltd., Little Hulton, Bolton; supply and erection of four electrically driven 50-ton overhead travelling cranes for locomotive repair shop, Wolverhampton, and two electrically driven 25-ton overhead cranes: Wharton Crane and Hoist Company, Reddish, Stockport; construction of twin-screw tug: Chas. Hill and Sons, Ltd., Bristol; twenty-four electric 3-ton luffing jib cranes for Newport, Cardiff and Swansea: Stothert and Pitt, Ltd., Bath; supply and erection of belt coal conveyor at Roath Dock, Cardiff: Spencer (Melksham), Ltd., Melksham.

MANCHESTER ASSOCIATION OF ENGINEERS.—About sixty members of the Manchester Association of Engineers visited the works of Hans Renold, Ltd., Didsbury, on Wednesday, 16th inst. This firm now has over 2000 employees, and is engaged in the production of driving chains and chain wheels. Its chief manufacturing problem is the production of large quantities of small parts to extremely fine limits, and the various processes necessitate the employment of highly specialised machines, many of which have been designed and constructed by the firm. The general impressions left by a visit to the works, were the extreme care taken in the selection of raw materials, the mechanisation of all manufacturing processes for the production of large quantities of accurately finished parts, the care devoted to inspection and testing of the finished product, and the provision of healthy conditions for the workers. In responding to the vote of thanks proposed by Mr. G. E. Windeler, the President of the Association, Mr. Herford, the works director, gave some interesting particulars of the company's policy and methods.

MERCHANDISE MARKS ACT, 1926.—The Board of Trade has referred to the Standing Committee appointed under the Merchandise Marks Act, 1926, an application for an Order in Council to require the following classes and descriptions of imported goods to bear an indication of origin:—(1) Air and gas compressors and exhausters and beds, casings, cylinders, rotors and heads therefor; (2) pneumatic tools and appliances, including mining coal cutters operated by compressed air, and cylinders, heads, pistons and valves therefor; (3) electricity meters which register by integration over a period of time the consumption, or quantity, of electricity used in any electric circuit, and (4) the following parts of such meters, viz., the case, the rotor, the shunt system and the series system. Representatives of any interests substantially affected by the application who desire to be heard in opposition at the Public Inquiries, which will be held later by the Committee, should communicate with the Secretary, Mr. E. W. Reardon, at the Board of Trade Offices, Great George-street, London, S.W. 1, as early as possible and in any case not later than August 31st, 1930.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST,	
(1) Native	17/9 to 18/6
(1) Spanish	20/6 to 21/–
N.E. COAST—	
Native	18/– to 21/–
Foreign (c.i.f.)	20/–

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 19 6	—
No. 1 Foundry	3 19 0	—
No. 3 Foundry	3 16 6	—
N.E. COAST—		
Hematite Mixed Nos.	3 11 0	3 11 0
No. 1	3 11 6	3 11 6
Cleveland—		
No. 1	3 10 0	3 10 0
Siliceous Iron	3 10 0	3 10 0
No. 3 G.M.B.	3 7 6	3 7 6
No. 4 Foundry	3 6 6	3 6 6
No. 4 Forge	3 6 0	3 6 0
Mottled	3 5 6	3 5 6
White	3 5 6	3 5 6
MIDLANDS—		
(c) Staffs —	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 13 0	—
„ „ Foundry	3 17 0	—
(c) Northampton—		
Foundry No. 3	3 12 6	—
Forge	3 8 6	—
(c) Derbyshire—		
No. 3 Foundry	3 16 0	—
Forge	3 12 0	—
(3) Lincolnshire—		
No. 3 Foundry	3 11 0	—
No. 4 Forge	3 7 0	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 5 6 (*a*) / 4 8 6 (*b*) / 4 12 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
LANCS.—		
Crown Bars	10 5 0	—
Second Quality Bars	8 15 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	11 0 0	—
Best Bars	11 10 0	—
Hoops	12 0 0	—
MIDLANDS—		
Crown Bars	10 0 0 to 10 7 6	—
Marked Bars (Staffs.)	12 10 0	—
Nut and Bolt Bars	9 0 0 to 9 5 0	—
Gas Tube Strip	11 2 6	—

STEEL, (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates (Marine)	10 10 0	10 10 0
„ „ (Land)	10 0 0	10 0 0
Ship Plates, ½in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	9 0 0	8 15 0
Sheets (Gal. Cor. 24 B.G.)	12 15 0	12 5 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
„ „ (Land)	10 0 0	—
Joists	8 10 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	—
Billets	6 15 0 to 9 10 0	—
MANCHESTER—		
Bars (Round)	9 7 6	—
„ (Small Round)	7 17 6 to 8 0 0	—
Hoops (Baling)	10 0 0	9 15 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
„ (Lancs. Boiler)	9 15 0	—
SHEFFIELD—		
Siemens Acid Billets	9 10 0 (basis)	—
Hard Basic	9 2 6 and 9 12 6	—
Intermediate Basic	7 12 6 and 8 2 6	—
Soft Basic	6 10 0	—
Hoops	9 15 0 to 10 0 0	—
Soft Wire Rods	8 0 0	—
MIDLANDS—		
Small Rolled Bars	7 17 6 to 8 10 0	—
Billets and Sheet Bars	5 18 6 to 6 5 0	—
Galv. Sheets, f.o.b. L'pool	11 17 6	—
(2) Staffordshire Hoops	10 0 0	—
Angles	8 7 6	—
Joists	8 10 0	—
Tees	9 7 6	—
Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 12 6	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/– to 18/3
Block Tin (cash)	135 2 6
„ (three months)	137 0 0
Copper (cash)	47 8 9
„ (three months)	47 2 6
Spanish Lead (cash)	18 2 6
„ „ (three months)	18 1 3
Spelter (cash)	16 3 9
„ (three months)	17 2 6
MANCHESTER—	
Copper, Best Selected Ingots	52 0 0
„ Electrolytic	52 10 0
„ Strong Sheets	79 0 0
„ Tubes (Basis Price), lb.	0 0 11¼
Brass Tubes (Basis Price), lb.	0 0 10¼
„ Condenser, lb.	0 1 0¼
Lead, English	19 17 6
„ Foreign	18 5 0
Spelter	17 5 0
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

Tungsten Metal Powder	2/8½ per lb.	
Ferro Tungsten	2/5½ per lb.	
	Per Ton.	Per Unit.
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 12 6	7/–
„ „ 6 p.c. to 8 p.c.	£22 10 0	7/–
„ „ 8 p.c. to 10 p.c.	£22 0 0	7/–
„ „ Specially refined		
„ „ Max. 2 p.c. carbon	£33 10 0	10/–
„ „ „ 1 p.c. carbon	£38 0 0	13/6
„ „ „ 0·70 p.c. carbon	£39 0 0	15/–
„ „ „ carbon free	11d. per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£11 15 0 for home	
„ „ „	£11 0 0 for export	
„ Silicon, 45 p.c. to 50 p.c.	£11 10 0 scale 5/– per unit	
„ „ 75 p.c.	£19 0 0 scale 7/– per unit	
„ Vanadium	12/9 per lb.	
„ Molybdenum	4/2 per lb.	
„ Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£170 to £175	
Ferro Cobalt	9/6 per lb.	

FUELS.

SCOTLAND.
(*Prices not stable.*)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	12/6
„ „ Eli	13/–
„ „ Splint	14/– to 15/–
„ „ Trebles	12/– to 12/6
„ „ Doubles	11/9 to 12/–
„ „ Singles	11/– to 11/3
AYRSHIRE—	
(f.o.b. Ports)—Steam	13/3
„ „ Jewel	16/–
„ „ Trebles	12/6 to 13/–
FIFESHIRE—	
f.o.b. Methil or Burntisland—Steam	10/3 to 12/6
Screened Navigation	16/6 to 17/6
Trebles	13/– to 14/–
Doubles	12/–
Singles	11/6
LOTHIANS—	
(f.o.b. Leith)—Best Steam	11/6
Secondary Steam	11/–
Trebles	13/3
Doubles	12/–
Singles	11/–

ENGLAND.

	Export.
(8) N.W. COAST—	
Steams	20/6 to 21/–
Household	32/– to 51/–
Coke	20/– to 21/–
NORTHUMBERLAND—	
Best Steams	13/6
Second Steams	12/–
Steam Smalls	10/– to 10/6
Unscreened	12/6
Household	25/– to 37/–
DURHAM—	
Best Gas	14/9 to 15/–
Second	12/9 to 13/–
Household	25/– to 37/–
Foundry Coke	24/– to 26/–

SHEFFIELD—	Inland.	
Best Hand-picked Branch	24/– to 25/6	—
Derbyshire Best Bright House	19/– to 21/–	—
Best House Coal	18/– to 19/6	—
Screened House Coal	16/– to 17/–	—
„ „ Nuts	14/– to 16/–	—
Yorkshire Hards	14/– to 15/6	—
Derbyshire Hards	14/– to 15/6	—
Rough Slacks	8/6 to 9/–	—
Nutty Slacks	7/– to 8/–	—
Smalls	3/– to 5/–	—
Blast-furnace Coke (Inland)	15/6 on rail at ovens	
Furnace and Foundry Coke (Export), f.o.b.	17/– to 18/6	

(9) SOUTH WALES.

CARDIFF—	
Steam Coals :	
Best Smokeless Large	20/–
Second Smokeless Large	18/9 to 19/9
Best Dry Large	18/6 to 18/9
Ordinary Dry Large	17/6 to 18/–
Best Black Vein Large	18/3 to 18/6
Western Valley Large	18/– to 18/3
Best Eastern Valley Large	17/9 to 18/–
Ordinary Eastern Valley Large	17/6 to 17/–
Best Steam Smalls	13/6 to 14/–
Ordinary Smalls	12/6 to 13/–
Washed Nuts	19/– to 22/–
No. 3 Rhondda Large	20/– to 20/6
„ „ Smalls	15/6 to 16/–
No. 2 „ Large	17/– to 17/3
„ „ Through	16/– to 16/6
„ „ Smalls	14/– to 14/3
Foundry Coke (Export)	27/6 to 37/–
Furnace Coke (Export)	21/– to 21/6
Patent Fuel	22/–
Pitwood (ex ship)	27/– to 27/3
SWANSEA—	
Anthracite Coals :	
Best Big Vein Large	35/– to 37/6
Seconds	27/6 to 31/6
Red Vein	23/6 to 27/–
Machine-made Cobbles	41/6 to 45/–
Nuts	40/– to 46/–
Beans	24/6 to 27/6
Peas	20/– to 21/–
Breaker Duff	10/– to 10/6
Rubbly Culm	12/6 to 13/–
Steam Coals :	
Large	19/6 to 20/6
Seconds	18/– to 19/6
Smalls	12/– to 13/–
Cargo Through	15/6 to 16/–

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate : Joists (minimum), 12/6 ; Ordinary Ship, Bridge, and Tank Plates and Sections, 10/– if home consumers confine purchases from associated British Steel Makers. (*e*) Delivered Black Country stations.

French Engineering Notes.

(From our Correspondent in Paris.)

The Steel Comptoirs.

ALTHOUGH failing to secure perfect unanimity, the meeting at Liége was successful in constituting two separate international sales comptoirs, one for semi-manufactured steel and one for steel sections, this separation being made in deference to the wishes of the Belgian group. While the semi-manufactured steel comptoir will have its headquarters at Seraing, the girder comptoir will be established in Paris. The Forges de Clabecq made claims that could not be accepted, and that company has definitely decided to hold aloof from the comptoir and is no longer a member of the Steel Cartel. The support of some others is doubtful, but nevertheless the Belgian group adhered to the comptoirs, which will come into operation on August 1st. This, however, is only a partial solution of the difficulties, for if the negotiations to constitute a comptoir for the sale of bars, sheets and hoops by December 31st next should fail the Steel Cartel itself will automatically cease to exist. Such a contingency is too serious to be contemplated, and no efforts will be spared to create the comptoir and ensure a renewal of the Cartel, the operations of which are regarded as essential to the well-being of the steel trade. Foreign orders for semi-manufactured steel and steel sections will continue to be received by makers, who will pass them on to the comptoirs for distribution and the comptoirs will see that the minimum prices are observed. As regards other classes of material, all limitation and control of production and prices have been withdrawn, and this state of things will continue until the comptoir for bars and sheets is formed.

Shipbuilding.

A first measure for the encouragement of shipbuilding is incorporated in two Bills which the Government will introduce into the Chamber of Deputies very shortly. One of these Bills provides for an extension of the Crédit Maritime system, whereby an increased sum will be available for loans to shipowners at a reduced rate of interest for the placing of orders in French shipyards. It is also proposed to offer premiums to shipbuilders for any increase beyond specified speeds, this being done, it is said, in the national interest, as it is desirable to obtain the maximum practical speeds in the mercantile fleet. The other Bill aims at offering "compensation" to shipbuilders to enable them to compete with foreign shipyards and prevent orders for ships from going abroad. These financial measures are well received in France and are regarded as a first step towards a reorganisation that will place the shipbuilding industry on a more satisfactory basis.

Trans-Pyrenees Railway.

The construction of the third railway through the Pyrenees is being delayed by the slow progress of work on the Spanish side. The French expect to complete the permanent way from Saint-Girons to Oust by 1932 as arranged, and they cannot do more until they are notified by the Spanish Government that the line from Lerida to Sort is constructed, as it is from this point that the Pyrenees section begins. By the terms of the convention the whole line must be completed within ten years of such notification. So far the Spanish Railway Administration has only laid about 16 miles of line between Lerida and Balaguer, and at this rate work on the Spanish side is likely to drag along interminably. The plans for the tunnel have not yet been settled. The French are anxious to complete as soon as possible this third railway through the Pyrenees, which will provide the shortest route between Paris and Madrid.

Foreign Trade.

There was a decline in the foreign trade during the first six months of the year that would have been much more considerable if it were not for the heavy harvest that reduced the importations of foodstuffs and allowed of a large export of bounty-fed wheat. The total imports were valued at 26,850 million francs, a decline of 3752 million francs as compared with the first half of last year, and exports amounted to 22,663 million francs, a decrease of 2054 million francs. While the imports of "material necessary for industry" increased by nearly two and a-half million tons, the value fell by 2778 million francs. This reduction in value may be partly attributed to cheaper coal, imports of which rose from 14,532,840 tons in the first half of 1929 to 15,924,523 tons. The imports of manufactured goods were valued at 5772 million francs, an increase of 992 million francs. During the past three years there was a considerable increase in the imports of machine tools and pneumatic tools. In exports there was a decline of 1006 million francs in "material necessary for industry" and of 1212 million francs in manufactured goods.

Irrigation and Power.

The annual rainfall in North Africa is sufficient for all normal requirements, but it is very irregular, torrential rains being followed by long periods of drought, and there is the same irregularity over a number of years. The storage of water is therefore of vital importance to a country like Algeria, where it is employed not only for irrigation, but also for the distribution of electrical energy. The schemes in hand are so numerous that their execution will involve an enormous expenditure, but eight new barrages have already been completed or are under construction, one of them, the Ghrib, holding up 230 million cubic metres of water. These works will be followed by the construction of a dozen other barrages. Already there are fifty-nine power stations in Algeria with a capacity of more than 91,000 kilowatts. Nevertheless, fuel power plants continue to be laid down, and in Algiers the Société Algérienne d'Eclairage et de Force is constructing the largest station in the country with five Stirling steam generators, which number will be doubled later on. There will be two turbo-alternators of 12,000 kW each and two of 6400 kW, and it is proposed to install eventually five more sets each of 25,000 kW. The boilers will use distilled sea water. In Morocco work is proceeding with the construction of the barrage on the Moulouya, which will irrigate vast areas of land in the French and Spanish zones.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

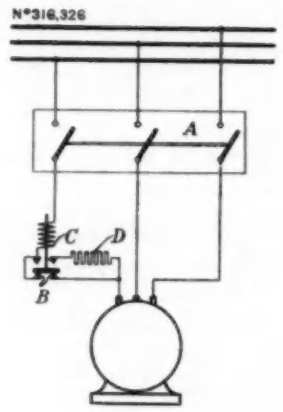
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

DYNAMOS AND MOTORS.

316,326. July 27th, 1929.—POLYPHASE ASYNCHRONOUS MOTORS, Siemens-Schuckertwerke Aktiengesellschaft, of Berlin-Siemensstadt, Germany.

It is proposed to give a steady start to three-phase asynchronous motors by impressing upon one phase of their primary circuit a potential differing from the other phase potentials. Starting devices of this nature can be used with advantage in the textile industry. The motor starts up for a short time with symmetrical phases as a normal machine, and consequently

N°316,326

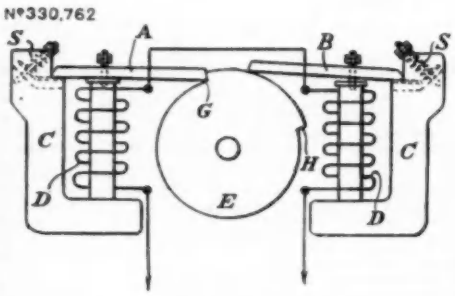


develops a high torque, which soon afterwards is reduced in order to obtain smooth starting up. On the closing of the switch A the current flows at first through the contacts B and the relay coil C without the starting resistance D coming into operation. A moment later, in consequence of the starting current, the relay attracts its armature and thus brings into play the resistance D. When the motor reaches its working speed the starting current falls to the normal working current and the relay C allows its armature to fall and thus switches out the resistance D.—*June 19th*, 1930.

330,762. June 6th, 1929.—MEANS FOR CONTROLLING ELECTRIC MOTORS, Clarke, Chapman and Co., Ltd., and Archie Read, both of Victoria Works, Gateshead-on-Tyne, Durham.

When a motor of the reversing type is employed it may be necessary that reversal should not occur too rapidly, and the object of this invention is to provide means whereby this can be prevented. An arrangement, incorporated in the control gear, prevents reversal except when the motor has come to rest. The disc E is attached to the barrel shaft of a controller and springs S hold the pawls A and B out of engagement with the stops G H. As the armature speeds up, however, the back

N°330,762

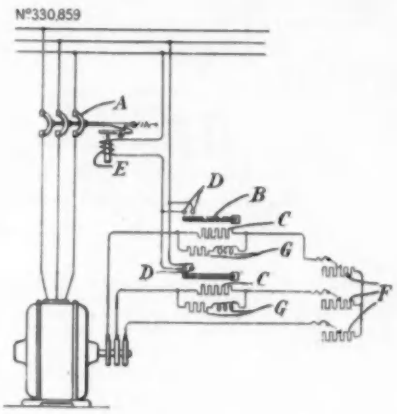


E.M.F. excites the magnet windings D and the pawls A and B are pulled down towards the disc and they remain in this position as long as the motor is allowed to run. As soon as the controller handle is brought to the "off" position one pawl A or B will encounter one stop G or H, the point at which this occurs being made such that the circuit is broken and the motor stops. As soon as the rotor has ceased to revolve the pawls A and B will be released and the motor can then be reversed. The same sequence of events will occur with the opposite direction of rotation, but the disc will be controlled in this instance by the other pawl.—*June 19th*, 1930.

330,859. October 21st, 1929.—PROTECTIVE DEVICES FOR INDUCTION MOTORS, *The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C.* 2.

The object of this invention is to provide a protective device for induction motors which will disconnect the primary winding from the alternating-current circuit at a predetermined current in the rotor at normal speed, and which will disconnect the primary winding from the alternating-current circuit at a lesser current in the rotor circuit as the speed of the rotor decreases. In this way the motor is amply protected against overheating throughout the entire range of variation of speed of the rotor because the maximum current which is permitted to flow in the rotor circuit decreases in accordance with the decrease in speed thereof and the consequent reduction in its capacity for the dissipation of heat due to decreased ventilation. The thermal relay for controlling the circuit breaker A includes a bimetallic element B having a heating coil C and contacts D which are arranged to complete a circuit between the trip coil E and the alternating-current mains when the heating coil C is energised sufficiently to move the bimetallic element B into engagement with the contacts. At full speed of the motor the frequency in the rotor circuit will be quite low, and as the speed is decreased owing to changes in the adjustment of the resistance F or on account of a change in load, the frequency in the rotor circuit will increase. In order to control the heating of the coil C in accordance with the frequency and current in the rotor circuit, a reactance G is provided, the impedance of which increases with the frequency in the rotor circuit. This impedance is of such value that when the motor is running at normal speed and the frequency is low in the rotor circuit a large proportion of current in the rotor circuit flows through the reactance G and the heating of the coil C will not be sufficient to cause the bimetallic element B to bridge the contacts D until the motor is substantially overloaded. As the speed of the motor decreases, however, the frequency in the rotor circuit increases and a large proportion of the current flowing in the rotor circuit flows through the heating coil C, so that the bimetallic element

N°330,859



B will be caused to bridge contacts D at very much less current in the rotor circuit than at normal speed of the rotor. In this way the current flowing in the rotor circuit at normal speed does not open the circuit breakers A and disconnect the primary winding from the alternating-current circuit until it is substantially overloaded, and when the speed decreases the current flowing in the rotor circuit which will disconnect the motor from the alternating-current circuit is made small enough to prevent overheating of the motor. Moreover, the rotor current required to disconnect the motor from the alternating-current circuit is caused to vary directly as the speed of the rotor and inversely as the frequency of the rotor circuit.—*June 19th*, 1930.

TRANSFORMERS AND CONVERTERS.

330,720. May 8th, 1929.—ELECTRIC TRANSFORMERS, Edouard Fries, of Hersham, Walton-on-Thames; and Hackbridge Electric Construction Company, Ltd., of Hersham, Walton-on-Thames.

This invention relates to transformers of the oil-immersed type. A indicates the transformer tank with which is associated the radiators B extending outwardly from the wall of the tank and connected thereto, in the construction Figs. 1 and 3, by means of the outlet ports C adjacent to the upper portion of the tank, and in the construction illustrated in Figs. 2 and 4 by means of the inlet ports D adjacent to the base of the tank. In the construction Figs. 1 and 3 a pump E is provided connected by means of the pipe F with a tubular distributor pipe G within the tank adjacent to the upper portion thereof and provided with jets H extending laterally therefrom in register with the outlet ports C. By means of the pump E an excess pressure of oil in

N°330,720

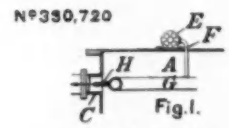


Fig. 1.

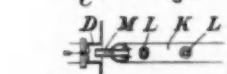


Fig. 2.

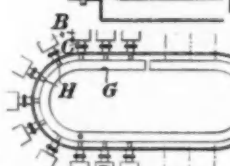


Fig. 3.

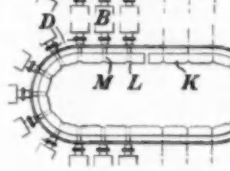


Fig. 4.

the distributor pipe G may be maintained over the pressure of the main body of oil in the tank, thereby forcing oil through the jets H and effecting an injector action into the outlet ports C whereby circulation of oil from the tank into the radiators will be promoted. In the construction Figs. 2 and 4 a tubular distributor pipe K situated within and adjacent to the base of the tank is provided with openings L directed towards the axis of the tank and extending transversely through the distributor pipe. Jets M register with the inlet ports D. In this construction an excess oil pressure is maintained within the distributor pipe K over that of the main body of the oil in the tank by means, for example, of an external pump, not shown, connected with the distributor pipe by means of the pipe N, and the oil flowing through the openings L will produce an ejector effect from the jets M, thereby inducing oil to flow from the inlet ports D through the jets and thus promoting the flow of oil from the radiators into the tank.—*June 19th*, 1930.

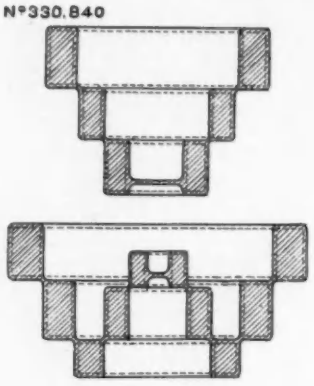
TRANSMISSION OF POWER.

330,840. September 24th, 1929.—THE PRODUCTION OF BALL RACES FOR BALL BEARINGS, E. Becker and R. Suchoparek, both of Kladno, Czecho-Slovakia.

This invention is concerned with the production of the races for ball and roller bearings, which, it is claimed, have been pro-

duced in the past by comparatively expensive processes, such as the machining of solid rods or the cutting off of specially made tubes. As an alternative the inventors produce a set of concentric race blanks, from a piece of steel cropped off a billet, in a

N°330,840

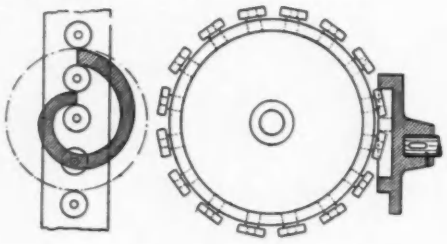


simple pressing operation. The individual races are then separated by another stroke of the press and are sent to the machining department. The illustration shows two arrangements of groups of races with three and five races made respectively from one blank.—*June 19th*, 1930.

330,758. June 5th, 1929.—GEARING, H. Wilhelmi, 377, Hingbergstrasse, Mulheim-Rhur-Heissen, Germany.

This gear is intended for high ratios of speed and is claimed to be reversible. Its construction needs little description, in view of the drawings. One of the shafts terminates in a spiral-

N°330,758



shaped cam and the other is furnished with a wheel on the periphery of which there are a number of roller studs. The axes of the shafts are slightly out of line, so that the scroll engages only one stud at a time. The ratio of the gear depends only on the number of studs on the wheel.—*June 19th*, 1930.

FURNACES.

330,844. September 27th, 1929.—FURNACES FOR THE HEAT TREATMENT OF RAILWAY TIRES, J. Baker and Co. (Rotherham) 1920 Ltd., and S. E. Baker, Kilnhurst Steel Works, near Rotherham, Yorks.

For the purpose of heat-treating tires of railway or tramway vehicles the inventors introduce them into a circular vertical furnace upwardly from the bottom. At the same time the

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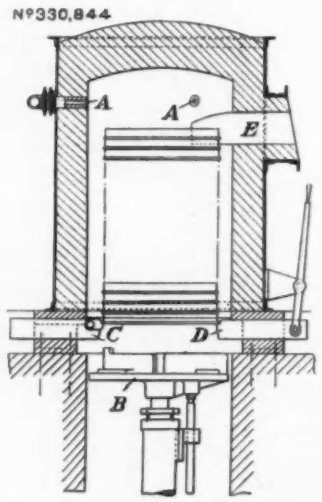


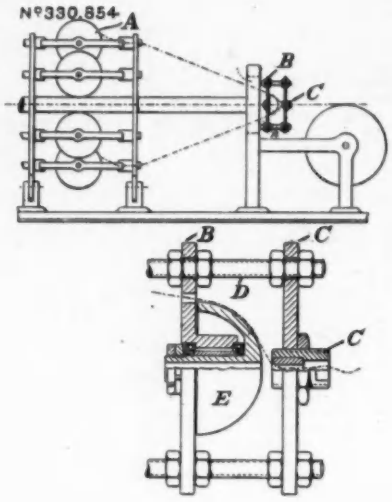
furnace is heated by a downgoing flame from burners at the top, two of which are shown at A A. The tires are introduced into the furnace by the hydraulic ram B, on which they are placed individually and are then pushed upward. The stack of tires in the furnace is supported on catches, which may be of the hinged variety as shown at C, or of the sliding type—see D—and as each tire has passed through the process it is withdrawn from the furnace through the door E.—*June 19th*, 1930.

MACHINE TOOLS AND SHOP APPLIANCES.

330,854. October 14th, 1929.—A MACHINE FOR THE MANUFACTURE OF WIRE ROPES FREE FROM BACK-TWIST AND UNTWISTING TENDENCY, *W. O. Larmuth, Todleben Ironworks, Unwin-street, Cross-lane, Salford.*

In this wire rope stranding machine the wires are brought from the bobbins A through the lay plate B to the stranding bush C. The bush and the lay plate are connected with the spindle of the bobbin carrier by the bolts D and consequently rotate therewith. The relative positions of the several parts can be adjusted by means of the nuts shown. Mounted on ball bearings on the lay plate there is a dome-like piece E, over which the wires are led. The angle which the wires have to traverse in passing from the surface of the dome into the

N°330,854



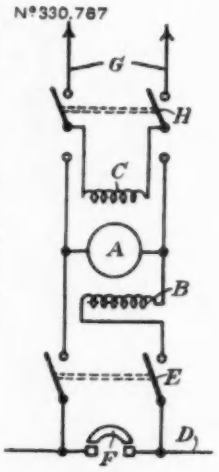
stranding bush is described as being approximately 90 deg., and is sufficient to overcome the elastic limit of the metal.—*June 19th*, 1930.

SHIPS AND BOATS.

330,787. June 27th, 1929.—ELECTRICAL PROPULSION OF SHIPS, Gustaf Adolf Juhlin, of "Redscar," Moss-lane, Timperley, Chester; and Associated Electrical Industries, Ltd., of Bush House, Aldwych, Westminster.

This invention relates to marine propulsion and in particular to systems of propulsion wherein direct current electric generators connected in series driven by individual internal combustion engines are employed to supply current to an electric motor or motors mechanically connected with a propeller shaft. In such systems, when it is desired to remove a generator and its associated engine from service, it is necessary to short circuit the generator before disconnecting it from the electric mains, and where the generators are provided with a series field winding, which is commonly the case, a voltage will exist at the terminals of the disconnecting switch at the moment of interruption, and sparking and damage of the switch contacts will be caused. According to the invention, in order to reduce the current flowing at the time of disconnection, the main field winding of the generator is arranged so that the excitation produced thereby can be caused to oppose that due to the series field winding and thereby reduce the total generator field and the voltage and current produced when the generator is short circuited. The armature of the main generator is indicated at A, its series field winding at B and its main field winding at C. Isolating switches connecting the main generator to the electric mains D are indicated at E, and the short-circuiting switch to enable the main generator to be disconnected from the mains is indicated at F. In the particular arrangement shown the main field winding C of the generator is normally supplied with current from supply leads G. A change-over switch H is provided, by which the winding C can be disconnected from the supply leads G and connected to the terminals of the armature A in such a manner that the current from the field winding C shall oppose the excitation due to the current in the series field winding B and thereby reduce the voltage of the machine at the time that the short-circuiting switch F is closed. Three other arrangements are also described.—*June 19th*, 1930.

N°330,787

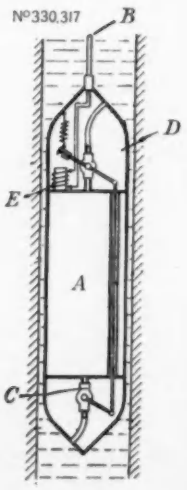


MISCELLANEOUS.

330,317. June 12th, 1929.—TAKING SAMPLES FROM BOREHOLES, Siemens-Schuckertwerke Aktiengesellschaft, Berlin-Siemensstadt, V. Gutmann, 25, Friedrichstrasse, Nurnburg, and L. Steiner, 39, Brandenburgischstrasse, Berlin, Germany.

This device is intended for the sampling of the contents of oil wells, a process which, it is claimed, has been subject in the past to various disabilities. The sample is taken in a vessel A, which is lowered into the well by means of a cable B. This cable is wound on a drum at the surface, which indicates the depth of the vessel. The sample is admitted to the vessel by means of the cock C, while another cock D acts as a vent. These two cocks are interconnected mechanically and are operated as desired by the electromagnet E, which is energised by current sent down the supporting cable B.—*March 14th*, 1930.

N°330,317



330,639. March 15th, 1929.—THE ELECTROLYTIC DEPOSITION OF METAL ON METAL TUBES, J. Stone and Co., Ltd., Deptford; W. Lambert, 41, Bromley-road, Catford, London, S.E. 6; and R. W. Wild, 83, Culverley-road, Catford.

This invention is concerned with the chromium plating of the interior of condenser tubes. It is stated in the specification that it has been found best to make the cathodic connec-

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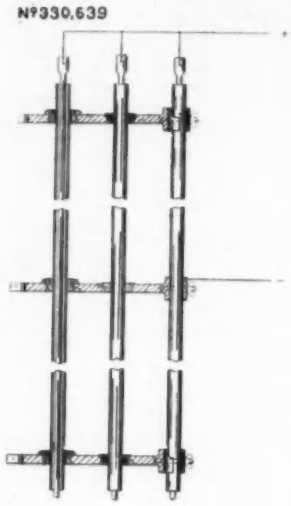

tion with the tube at the centre of its length only. As a consequence the tubes are supported in the electrolytic bath by means of a frame in which all the supporting connections are of an insulating character, except those at the middle. These supports only provide a path for the electric current, which is supplied by the taut anodes running throughout the length of the tubes. The illustration shows several alternative methods of supporting the tubes.—*June 16th*, 1930.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

WEDNESDAY to WEDNESDAY, SEPTEMBER 3RD to 10TH.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—Bristol meeting. The presidential address, by Professor F. O. Bower, will deal with "Size and Form in Plants." Evening discourses will be given by Professor E. V. Appleton, F.R.S., on "Wireless Echoes," and by Dr. R. E. Slade on "The Nitrogen Industry and our Food Supply." Evening receptions and excursions to points of scientific interest, works, &c., in the locality will be arranged.

THURSDAY to SUNDAY, SEPTEMBER 4TH to 7TH.

INTERNATIONAL CONGRESS OF CONSULTING ENGINEERS.—Fifth Congress at Vienna.

TUESDAY to FRIDAY, SEPTEMBER 9TH to 12TH.

INSTITUTE OF METALS.—Annual autumn meeting, Southampton. Continued from September 13th to September 16th by a visit to France. The meetings at Southampton will be held in the Chantry Hall, and on September 9th Professor D. Hanson will read a paper on "The Use of Non-ferrous Metals in the Aeronautical Industry." 8 p.m. For programme see page 88.

FRIDAY, OCTOBER 31ST.

OVERHEAD LINES ASSOCIATION.—Annual conversazione.

LAUNCHES AND TRIAL TRIPS.

MACGREGOR LAIRD, motor ship; built by David and William Henderson and Co., Ltd., to the order of the African Steamship Company, Ltd.; dimensions, 370ft. by 51½ft. by 33½ft.; to carry 5650 tons. Engines, eight-cylinder, single-acting, airless injection, 740 mm. diameter by 1500 mm. stroke; constructed by Harland and Wolff, Ltd.; trial trip, July 3rd.

PRINCE DAVID, turbine steamer; built by Cammell Laird and Co., to the order of the Canadian National Steamships; dimensions, 385ft. by 57ft. by 20ft. Engines, single-reduction geared turbines; constructed by the builders; trial trip, July 4th.

POMEROL, steamship; built by David and William Henderson and Co., Ltd.; dimensions, 236ft. by 34ft. by 16ft. 9in.; gross tonnage, 1200. Engines, triple-expansion, 18in., 30in. and 50in. diameter by 36in. stroke, pressure 200 lb. per square inch; constructed by the builders; trial trip, July 8th.

CHATEAU LAROSE, steamship; built by David and William Henderson, Ltd., to the order of Worms and Co.; dimensions, 274ft. by 39ft. by 23ft.; gross tonnage, 1400. Engines, triple-expansion, 20½in., 34in. and 56in. diameter by 42in. stroke, pressure 200 lb. per square inch; constructed by the builders; launch, July 10th.

EL MIRLO, motor ship; built by the Blythswood Shipbuilding Company, Ltd., to the order of Lobitos Oilfields, Ltd.; dimensions, 460ft. by 60ft. by 34½ft.; 11,500 tons deadweight capacity. Engines, eight-cylinder crosshead type single-acting Diesel, 740 mm. bore by 1500 mm. stroke; constructed by J. G. Kincaid and Co., Ltd.; launch, July 10th.

LAGANBANK, motor ship; built by Harland and Wolff, Ltd., to the order of Andrew Weir and Co.; dimensions, 425ft. by 57ft. by 38ft. 7in.; gross tonnage, 5680. Engines, two eight-cylinder, airless injection Harland-B & W; launch, July 10th.

NAVBOER, motor tank ship; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of A/8 Havboer; dimensions, 460ft. by 59ft. 6in. by 34ft. 1in.; to carry oil in bulk. Engines, Wallsend-Sulzer type Diesel, 3000 B.H.P.; trial trip, July 10th.